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UNIVERSITY OF ALBERTA

Perceived Causal Attribution Factors to Academic Performance: A Multi-level Analysis.

By

Joseph Mbithi Kivilu ©

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of DOCTOR OF PHILOSOPHY.

Department of Educational Psychology

EDMONTON, ALBERTA
Fall/1994

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FACULTY OF GRADUATE STUDIES AND RESEARCH

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Dedication

To my beloved wife, Nthambi,

and children Mueni, Kivilu, and Kioko.

Abstract

The objective of the present study was to investigate the causal attribution factors used by high school students in Kenya to explain their perceived performance in mathematics. Demographic differences and relationships between gender and cultural experiences and causal attribution factors of attribution were investigated. A sample of 341 high school students were selected using stratified sampling. Both urban and rural schools participated in the study. A causal-comparative research design discussed by Kerlinger (1986) was adopted for the study. A causal attribution scale to measure perceived performance in mathematics was first developed and validated. Six causal attribution factors hypothesized to be used by students in making their attributions to perceived performance were confirmed through factor analysis. The six factors were: Instructional Strategy, Ability, Personal Organization, Effort, State of Health and Home Environment. Analysis of Variance procedure found no significant differences in the mean ratings of the causal attribution factors when compared on the basis of gender and region. However, Hierarchical Linear Modeling (HLM) results indicated that there were significant gender and region variations in the mean ratings of the causal attribution factors. The findings showed that Instructional Strategy was mostly used to make attributions for perceived success, while lack of ability was used for perceived failure. Effort was considered of least importance in making attributions to either perceived success or perceived failure. These findings do not agree with research results obtained from Western and Asian subjects. In both socities effort is considered important in making either success or failure attribution. The findings of the study agree with what has been found in Asian countries and among non-Caucasian subjects who attribute success to external factors and failure to internal factors. Implications of the findings to classroom instruction to improve performance in mathematics are cited. Recommendations are made for further research aimed at improving the validity of the results.

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by her that what I was doing was for the best interests of the family gave me the power to work even harder.

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I. Introduction

Background of the Study

The issue of academic performance continues to be of great concern to parents, school administrators, teachers, students and the public in general. Questions have always been raised as to what factors are responsible for the quality of academic performance at the various levels of schooling. In a number of studies done in Kenya, Eshiwani (1990) identified several policy-related factors that influence academic performance by secondary school students. These factors include the following:

a) School resources and processes: class size, textbooks, school administration and management (Board of Governors), library, and laboratory facilities.

b) Teacher characteristics: teacher certification, experience, training, teacher-pupil ratio, and professional commitment.

c) Student traits: pre-primary education, primary education and social characteristics.

Other factors also identified in numerous studies include: achievement motivation, home environment and social economic status (Muola, 1991).

The factors frequently cited are either internal (something within the person), like ability, effort, and the level of motivation, or external (something in the environment), for example, teachers' level of training, quality of teaching, school equipment, school administration and parental support. An academic outcome usually depends on a combination of personal and environmental factors. The numerous studies that have been carried out in Kenya to investigate the causes of poor academic performance have mostly focused on the environmental or external factors to the student (e.g., Eshiwani, 1990; Otieno, 1991; Waweru & Koske, 1991). Attention needs to be directed to both internal and external factors as perceived by students as being responsible for their performance in academic tasks. The main reason for this suggestion is that both factors (internal and external) have implications for achievement motivation as will be explained in Chapter 2. In other words, more research should be done to investigate the student's perceived causal attributions to academic performance. Also, in a country that follows a common education curriculum in both urban and rural areas, an investigation into whether students with different cultural experiences exhibit different causal attributional factors for their academic performance is worth doing for reasons discussed in the following sections.

A review of existing research on learning suggests that the self-system, which includes constructs such as self-efficacy, locus of control, achievement motivation, and attributional beliefs, is a complex, interdependent system that supports academic performance (McCombs, 1986). According to Covington and Omelich (1985), self-worth is maintained by the manipulation of attributional beliefs about success and failure. In self-worth theory, children who maintain effort-related attributions are likely to put more effort in order to gain success; for these children, failure is caused by lack of effort.

The theoretical model most frequently used to help understand and explain classroom performance following success and failure is the one proposed by Weiner (1972, 1980a). According to this model the causal attributions given by students to explain their success and failure in a given academic task are: mental ability, effort, task difficulty, and luck. Other causal attribution factors have also been identified, for example, acquired characteristics, interest in the task, attention, teacher, family, and physiological processes (Cooper and Good, 1983). The causal attribution factors in Weiner's model are categorized along a number of dimensions: locus (internal vs. external), stability (stable vs. unstable), and controllability (controllable vs. uncontrollable). The perceived stability and controllability of the attributions as well as the extent to which the determining factors are subject to internal or external influences are all considered to affect future effort and expectations.

If, for example, failure in mathematics is attributed to an unstable cause (e.g., difficulty of questions, bad luck), then failure can presumably be avoided in the future, and subsequent efforts to attain success should not be affected. If however, failure is attributed to stable causes (e.g., I can never understand mathematics, I have lost hope in mathematics), then the individual may come to believe that failure is inevitable, that is she/he is unable to influence future outcomes, and therefore there is no point in continuing to try. The perceived reasons for success are equally important. If success is attributed to an external or unstable cause, success is not assured in the future and similar tasks may be regarded as being unattractive and to be avoided. Attribution of success to an internal and stable cause would lead to expectations of future success and continued efforts on similar and related tasks. Appropriate attributions, especially those related to effort about success, facilitate achievement by fostering feelings of positive self-worth. Generally, functional attributions are hypothesized to lead to continued or increased efforts, while inappropriate attributions of success and failure may lead to cognitive, motivational and/or emotional deficits.

An understanding of the causal attribution factors for a given academic task from the students' perspective is important for teachers in designing attribution change programs. These are programs that attempt to enhance motivation by altering students' attributions for successes and failures. For example, because effort is under volitional control, training students to believe that prior difficulties resulted from low effort may lead them to expend greater effort with the expectation that it will produce better outcomes.

Statement of the Problem

The purpose of this study was to investigate the causal attribution factors used by high school students in Kenya to explain their perceived performance in mathematics. Demographic differences in these causal factors across gender and cultural experiences were also investigated. More specifically the study was aimed at achieving the following objectives:

a) To construct a questionnaire that could be used to assess the perceived causal attributions to performance in mathematics.

b) To explore causal attributions to performance in mathematics by high school students using the measure developed in (a) on a sample of males and females drawn from both rural and urban high schools in Kenya.

c) To confirm and interpret the factors of perceived causal attribution in mathematics as measured with the scale constructed in (a).

d) To investigate the existence of significant relationships and differences between the factors and other variables such as perceived performance in mathematics, cultural experience (urban/rural), and gender.

In order to carry out these investigations the following hypotheses were formulated to facilitate the application of various statistical techniques discussed in Chapter 3. The rationale underlying each of these hypotheses will be derived from the literature reviewed in Chapter 2.

a) Ability, Personal Organization, Effort, State of Health, Home Environment, and Instructional Strategy will account for significant variance in the causal attributions made in mathematics by Kenyan high school students.

b) The gender of the student will have no significant influence on the ratings students assigned to the six causal attribution factors.

c) The contextual characteristic of the school as measured by region and the mean of socio-economic status of the students will have no significant influence on the causal attributions made by high school students.

Significance of the Study

The findings of this study will make a contribution to the theory and practice of causal attribution and motivation in general. The findings will be useful in understanding the role of causal attributions to the teaching/learning process especially as it relates to achievement motivation.

The findings will be of value to teachers, school counsellors, school administrators, and parents, in devising ways and strategies (attribution change programs) for improving student's performance, particularly in mathematics.

The findings of the study are also expected to provide a basis for studying causal attributions in other subjects and events that may be thought to influence student's performance in school in general.

Finally, the findings will add empirical evidence for the existence of a number of factors used to explain a wide variety of causal attributions made by students for their academic performance.

In addition to its theoretical contribution this study has a methodological significance. Studies using students as subjects have traditionally been done using students as the unit of analysis ignoring the effects of classrooms and schools on some students' characteristics. Currently researchers have realized the importance of taking into consideration the multi-level nature of most school data. This study will add to the increasing research evidence of the advantage of recognizing the hierarchical structure of most social institutions and use of the appropriate research design and statistical analysis of data emanating from such institutions.

Operational Definition of Terms

Some terms used in the thesis may take various meanings when used in different contexts. The following are operational definitions of some of the terms as used in this thesis.

Cultural Experience

Culture refers to the behavior or way of life of a definable group of people. It is the learned and expected ways of life shared by members of a society: attitudes, beliefs, motivation and value systems known to the group. Cultural experience is defined as a way of life as dictated by the environment. Students with an urban cultural experience will be those who have been born and raised in the city of Nairobi. They have done both their primary and secondary education in the city, and live with their parents in one of the residential areas of the city. Similarly, students with a rural cultural experience will be those who are born and raised in a typical rural area. They must have attended both primary and secondary rural schools. Region, coded urban 1, rural 2 is used in the thesis to denote these two cultural experiences.

Socio-Economic Status (SES)

Socio-economic status is defined as the relative rank in a hierarchy of social and economic factors. Information on this variable was obtained from the students' personal files. It was considered a multi-dimensional concept made up of the following measures: family income, father's level of education, and family size. These were the measures of the concept that were considered relevant to the objectives of the study. Each of the three measures were rated on a four point scale and the average formed the rating for each student on the variable. The final ratings were put on a four point scale ranging from Low-1 to Very high-4. The mean SES denoted by (MNSES) was computed for each school and was used as a school-level variable in the hierarchical linear model analysis.

Instructional Strategy

Instructional strategy is one of the hypothesized factors of causal attribution. It represented the teachers activities during classroom instruction. The activities included teacher's methods or style of presenting mathematics subject matter, clarity of teacher's notes to the students, motivation by teacher, and grading of tests in mathematics. Students rated how well the listed activities contributed to their perceived performance (success or failure).

Ability

Ability refers to a natural or acquired competence in doing something. It includes sufficient power, capacity (to do something), cleverness and academic capability to perform a given task.

Effort

A conscious exertion of cognitive capability- a serious attempt or a try to achieve something desired. Attributing performance to effort will be termed as effort-attribution.

Personal Organization

Personal organization is defined as a person's manner or condition of being organized, of having a formal way of coordinating and carrying out activities. For the present study personal organization will be used to refer to the systematic planning of how to carry out a given activity in terms of time, actions to be taken, and other persons to be involved.

State of Health

State of health is defined as the condition of being sound in body, mind or spirit. It will refer to the physical and emotional state of a person.

Summary of the Thesis

The first phase of the study was devoted to generating a set of items for measuring perceived causal attributions to achievement in mathematics. The items were written in the form of a Likert scale in which students were given various statements regarding reasons that are normally given to explain performance, and then asked to rate them on a scale of 5-points ranging from strongly agree to strongly disagree. Reliability and validity of the items in providing the desired results were determined in a pilot study using a sample from the target population (see section on pilot study results in Chapter 3). Methods for determining these psychometric characteristics (reliability and validity) of the set of items are discussed in Chapter 3 under instrumentation. The target population was composed of all the form four students in the city of Nairobi and the rural district of Machakos, both in Kenya. Stratified sampling on the basis of school type, (boys only, girls only and mixed schools) was used to select the sample for the study.

Students responded to the items on perceived causal attributions with reference to their trial examination scores in mathematics. The main causal factors hypothesized in this study and discussed under Chapter 2 of the literature review, include: ability, personal organization, practice (effort), state of health, home environment, and instructional strategy. Factor analytic techniques (confirmatory) were used to establish the existence of the hypothesized causal attribution factors. The sum of scores for the items having large loadings on each factor was standardized and then used for statistical analysis. Three-way analysis of variance was first done on the groups, that is- students grouped on the basis of gender and urban versus rural schools for the causal attribution factor scores. Similar causal attribution factors were expected to be used by all groups, but the perceived importance of a given factor in explaining success or failure was expected to vary across groups. Relationships of the factors among the groups and with perceived performance in mathematics were investigated using hierarchical linear modelling approach. The ordinary regression procedure does not recognize that students in the study sample came from different schools, but the hierarchical approach disaggregates the relationship between the independent and dependent variables into two components, the within-unit and the between-units. The within-school component describes the relationship of observations inside the schools, and is thus addressed to individuals who attend the same school. The between-school component takes account of differences between schools. Technically, the regression coefficients estimated within units (schools) are used as outcome variables in the regression between units (Burstein, 1980; Burstein & Miller, 1980). The hierarchical linear model approach (HLM) is discussed in greater detail in Chapter 3.

The relevant literature is reviewed in Chapter 2 to provide a foundation for the study, while in Chapter 3, a discussion of the method, including the selection of the sample and the development of the instrument used is provided. Techniques for the analysis of the data are also discussed in Chapter 3. The statistical results of the data are contained in Chapter 4. The thesis closes with a discussion of the results, their implications, and suggestions for further research presented in Chapter 5.

II. Review of the Literature

Introduction

The relevant literature is reviewed in this chapter. The first section explores attribution theory in the context of motivation in achievement situations. It also relates causal attribution to the variables identified for use in the study. The second section reviews empirical studies that are of relevance and concludes with research questions for the study.

Theoretical Rationale: Attribution Theory

Attribution theory involves the study of perceived causality -people's beliefs about what causes social events, and why they happen as they do (Kelley, 1967). An attribution, according to Weary, et al., (1989), is an inference about why an event occurred or about a person's behavior. We make attributions about our own dispositions and experiences just as we make attributions about others. Hence attributions may be perceptions and inferences about others or about self. A cause, according to Weary, et al., (1989), is defined as that antecedent or set of antecedents that is sufficient for the occurrence of the effect. People use what they perceive as the cause(s) of an event to explain its occurrence, hence the term causal attribution.

People make attributions in various situations and for various reasons. For example, people will make attribution out of the need to understand, organize and form meaningful perspectives about events they observe every day. Attributions especially are prominent when people receive unexpected information, or negative outcomes, and when an event that is personally relevant occurs.

According to Heider (1958) the primary concern of attribution theory is how people in every day life understand the causes of their own and other's behavior. From a motivational perspective, attributions are important because they influence beliefs, emotions and behaviors.

The current popularity of attribution theory could be ascribed to several factors. In the sixties, when dissatisfaction with dissonance theory (Festinger,1957) was growing, a large number of psychologists realized the potential of attribution research in explaining and predicting a wide array of individual behavior (Dalal, 1988). Festinger's (1957) dissonance theory postulates that individuals attempt to maintain consistent relations among their beliefs, attitudes, opinions and behaviors. The relationship is maintained by changing discrepant cognitions to reduce dissonance or cognitive conflicts. According to Schunk (1991), dissonance theory does not predict which means will be used to reduce dissonance, that is, whether by changing behavior or by altering thoughts. Attribution theory seems to provide a solution to this limitation of dissonance theory by proposing ways of making desirable behavioral changes through attributional training. Attribution theory postulates that the manner in which people perceive causes of their own and of other's behavior influences the manner in which they will interact in a social situation. The theory has not only been applied in tackling problems like drug addiction, loneliness, achievement strivings and mental health, but also in developing appropriate attribution change training programmes in industry and social settings. Before discussing attributions in achievement settings, relevant theoretical background information is important. Discussed below are classical theories of causal attribution.

Classical Theories of Attribution

The basic question which occupied most of the earlier theorists was how do people infer the causality of events? As Harvey, Ickes and Kidd (1978) point out, the idea was to construct a broad and deep theoretical base that could account for all attributions which humans make regardless of the content of the attribution. Research was directed towards the discovery of the general rules people follow in ascribing causality. The rules were thought to be relatively stable generalizations of the causal logic that cuts across particular content domains. Three such classical theories by Heider (1958), Jones & Davis (1965), and Kelley (1967), have generated a large amount of research in the past three decades. Taken together, their work constitutes the basic theoretical contribution to attribution theory and, accordingly, forms the ground work for defining the field of attribution. In a way, the theories of Jones and Davis (1965) and of Kelley (1967, 1973) extended Heider's theory of attributional process that all causal inferences are based on the experiences and information which an individual has in a particular situation.

Heider's (1958) main contribution to attribution theory is his conception of the processes and variables involved in a person's attribution of causality. Heider suggests that people operate very much like quasi scientists in their attributional activities- they observe an event and then often in a logical analytical way attempt to discover the connections between the various effects and possible causes. He does not argue that people are always objective and rational in their behavior. Heider

(1958) explained the process of inferring causal attributions through the principle of invariance. Behavior can be determined by a variety of causes, but we tend to look for an association between a particular effect and a particular cause across a number of situations. If the given cause is invariably associated with a particular effect in many different situations, and if the effect does not occur in the absence of that cause, then we attribute the effect to that cause. Heider classified perceived causes as either internal (something within the person) or external (something in the environment). The internal or personal attribution involves motivation (trying) and ability (competence). An action outcome, according to Heider, usually depends on a combination of environmental and personal factors.

Jones and Davis (1965) extended Heider's principles to explain how an observer makes dispositional (internal) attributions. Their (1965) theory of Correspondent Inferences was the first explicit hypothesis-testing formulation in the area of attribution. The theory is basically concerned with factors that influence an observer's attribution of intent and disposition to another person. It does not explicitly address the questions of how individuals understand their own intentions and dispositions. According to this theory, a correspondent inference is an inference about individuals' intentions and dispositions that follows directly from or corresponds to their behaviors.

Jones and Davis (1965) view the cultural desirability of behavior as an important determinant of the attribution of intent and disposition. Behavior that is unexpected or low in desirability will be more informative to the perceiver and more conducive to a correspondent inference than will behavior that is expected or high in desirability (Weary et al., 1989). A second important determinant of correspondent inferences is the uncommon effects associated with an action. Uncommon effects represent distinctive outcomes that follow from an act. The fewer the uncommon effects associated with an act, the more likely a correspondent inference will be made. Jones and colleagues' correspondent inference theory represents a rational baseline model of the causal inference process; they present a conception of the perceiver as a rational person who evaluates information and makes logical inferences about others. Their theory focused less on the question of how a perceiver's needs, wishes, and motives influence attributions. However, they have suggested that their theory may serve as a model or norm to identify and study attributional biases. Jones and his colleagues have focussed mainly on person perception (or attributions to others) as opposed to self-perception. To date, the work of Jones and colleagues represents the most systematic, productive, and long-term program of work on processes involved in attribution to others (Weary, et al., 1989).

Kelley's Contributions to Attribution Theory

Kelley's (1967) review and analysis gave attribution theory and research much stimulation and an integrative approach to understanding both attribution to others and to self. Unlike Jones and Davis, Kelley assumed that his concepts apply equally well to self-perception as they do to person perception. Kelley (1967) theorized that people often make causal attributions as though they were analyzing data patterns by means of an analysis of variance (ANOVA), a statistical technique used to determine whether variance on a dependent variable of interest (e.g., performance) exceeds what would be expected by chance. In terms of attribution processes, the attributor is assumed to attribute effects to those causal factors with which they covary or with which they are correlated, rather than to those from which they are relatively independent. The principle of covariation between possible causes and effects is the fundamental notion in Kelley's (1967) attributional approach. In Kelley's formulation, the important classes of possible causes are persons, entities (things or environmental stimuli), and times (occasions or situations).

Kelley suggested that we are often interested in determining the conditions under which social behavior is attributed to internal or to external factors. To arrive at such a decision, three types of information are required:

(a) Distinctiveness - the extent to which the person acts in the same manner in other situations or only in one particular situation. High distinctiveness leads to external attribution, whereas low distinctiveness leads to internal attribution;

(b) Consensus - The extent to which all other persons act in a similar manner in that situation. High consensus leads to external attribution whereas high uniqueness leads to internal attributions; and

(c) Consistency - the extent to which the person acts in the same manner on other occasions in similar situations.

Kelley's theory predicts that people make internal attributions under the conditions of low distinctiveness, low consensus and high consistency. In contrast, external attribution is made under the conditions of high distinctiveness, high consensus and low consistency. There has been some controversy regarding an attributor's use of the three types of information specified by Kelley in his ANOVA model. Nisbett and Borgida (1975) found no evidence that consensus affects attribution. Work by Major (1980) revealed the weakness of consensus information relative to distinctiveness and consistency information in a situation in which the subjects could ask for different types of information to explain why an event occurred. The consensus-attribution controversy appears to be virtually resolved by the delineation of several conditions under which consensus is and is not influential. Kassin (1979) distinguishes between implicit and explicit consensus. Implicit consensus refers to the subjective, often normative expectancies for behavior in a situation while explicit consensus refers to the actual behavior in a situation. Kassin (1979) contends that the type of consensus and/or the discrepancy between types may be crucial to whether or not such information affects attribution.

The requirements of modern life, according to Kelley (1972a), frequently lead to deliberations in which decisions are made by reference mainly to present feelings, thoughts, and perceptions, the advice of others, and our past experience. Kelley (1972a) contends that past experience may provide individuals with a backlog of understanding relative to causal relations and that individuals can call on this store of knowledge when an inference has to be made quickly. This store of knowledge of causal relations represents what Kelley refers to as causal schemata. Kelley says that causal schemata are learned, stored in the person's memory, and then activated by environmental cues. Schemata presumably generalize on the basis of a broad range of objects and situations, and may be stimulated by numerous cues.

The idea of discounting in attribution was one other important statement articulated by Kelley (1972b). The principle of discounting relates to the situation involving an attributor who has information about a given effect and a number of possible causes. The role of a given cause in producing a given effect is discounted if other plausible causes are also present. Kelley (1972b) suggests that discounting is reflected in ways such as a person's feelings of little certainty in the inference that a particular cause led to a particular effect.

When there are multiple plausible causes of a given effect and when some of these causes are facilitative and others are inhibitory with respect to the effect, a reverse version of the discounting principle, which has been called the augmentation principle, is necessary (Weary, et al., 1989). According to this principle, if for a given effect, both plausible inhibitory and facilitative causes are in play in producing the effect, the facilitative cause will be judged greater than if it alone was present as a plausible cause for the effect. The important idea in the augmentation principle is that the facilitative cause must have been extremely potent if the effect occurred despite the opposing effect of the inhibitory cause.

Kelley has made a notable attempt to synthesize person perception (other attribution) and self perception concepts. He has also developed formal models of how people deliberately analyze information and make inferences, as well as models of how they do this quickly. As was true of the theoretical work of Jones and colleagues (1965), Kelley's analyses have been limited in terms of explaining how powerful motives and emotions interact with logical-rational processes to produce attributional phenomena.

The classical theories of attribution discussed above presume all human beings to be rational, utilizing available information to draw certain causal inferences to seek the truth. In that process, the individual is generating and confirming hypotheses concerning human behavior. In situations where personal biases influence the way people use available information and experiences to make causal attributions, the application of these theories is severely restricted (Dalal, 1988). For example, Miller and Ross (1975) have documented a large number of studies which reveal self-serving biases in the attribution of causality. The classical theories have only focussed on the antecedents of attributions, that is, the factors that determine the kind of attribution made and when. They certainly throw light on the process of attribution but do not predict the behavioral consequences of perceived causality.

It was recognized in later research that the attribution of responsibility has serious implications for other personal and social judgements, and for the attributor's subsequent behavior. Most prominent among the attribution theories focusing on this aspect is that of Benard Weiner.

Weiner's Theory of Attribution

Weiner (1980a, 1986) conceptualized an attributional theory of achievement behavior, suggesting that causal attribution to success and failure influences self-esteem and future expectations in important ways. Consistent with earlier work, Weiner focussed on the structure (not on the content) of causal attributions. Guided by Heider's work, Weiner et al. (1971) postulated that students attribute their academic successes and failures to ability, effort, task difficulty and luck. Weiner did not imply that these are the only attributions used by students to explain their successes and failures. Subsequent investigations identified other attributions: other people (teachers, students), mood, fatigue, illness, personality, and physical appearance (Frieze, & Snyder, 1980; Frieze, Francis, & Hanusa, 1983). Frieze et al. (1983) have shown that task conditions are associated with particular attributional patterns, for example, exams tend to generate effort attributions, whereas art projects are ascribed to ability and effort.

According to Weiner (1986), the three dimensions of causality along which all specific attributions can be classified are locus, stability and controllability. The locus dimension (whether the cause is internal or external) was conceptualized in the same manner as was done by Heider (1958) and Kelley(1967). According to Schunk (1991), the locus dimension is hypothesized to influence affective reactions. One experiences greater pride (shame) after succeeding (failing) when outcomes are attributed to internal causes rather than to external ones. Students experience greater pride in their accomplishments when they believe they succeeded on their own (ability, effort) than when they believe external factors were responsible (teacher assistance, easy task).

The stability dimension is hypothesized to influence expectancy of success. It refers to the temporal invariance of the cause, that is, whether the cause in question is likely to change over time (unstable) or is going to be present for sufficiently long time (stable). Assuming that task conditions remain much the same, attributions of success to stable causes (high ability, low task difficulty) should result in higher expectations of future success than attributions to unstable causes (immediate effort, luck). Students may be uncertain whether they can sustain the effort needed to succeed or whether they will be lucky in the future. Failure ascribed to low ability or high task difficulty is apt to result in lower expectations for future success than failure attributed to insufficient effort or bad luck. Students may believe that increased effort will produce more favorable outcomes or that their luck may change in the future. Ability may be viewed as internal and stable; effort as internal and unstable and chance as external and unstable. According to Weiner, these three causal dimensions are associated with different psychological processes. The locus dimension is associated with self-esteem related effects. If success is attributed to internal causes, it would enhance self-esteem, whereas if failure is attributed to internal factors self-esteem would go down. The stability dimension is found to be predictive of future success, for example, if success is attributed to stable factors it would lead to higher expectations of success in the future. The third dimension of controllability has diverse effects (Weiner, 1979). Feelings of control are postulated to increase one's choosing to engage in academic tasks, effort and persistence at difficult tasks, and achievement (Bandura, 1986; Dweck & Bempechat, 1983; Monty & Perlmutter, 1987; Wang, 1983). Students who believe they have little control over academic outcomes hold low expectations for success and display low motivation to succeed (Licht & Kistner, 1986).

The important contribution of Weiner's theoretical model is in terms of establishing a link between attribution and affects. Weiner suggested that affective reactions may be of two types: outcome-dependent and outcome-attribution-dependent. Several affective reactions are generated by causal attributions. In the work of Weiner, Russell and Lerman (1978, 1979), each causal dimension was found uniquely associated with a set of feelings. For example, success attributed to internal stable factors (like ability) would lead to feeling of competence and confidence whereas failure attributed to such factors would result in lack of confidence and a feeling of incompetence.

Weiner's theory, in a way goes much beyond the lay explanation of events (naive psychology), which was the major concern of the early theories. However, Weiner's theory does not address the attributional process, that is the cognitive activities that are involved in making certain attributions for the occurrence of some events but not others. In most of the work testing Weiner's theory, attributions are given as part of the experimental manipulation. Although this approach does not throw light on the causal search process, it has important practical implications.

Several criticisms have been made of attribution theory. Alcock et al. (1991) stated three of these criticisms as follows:

> (1) that attribution theory is peculiar to a particular culture and does not describe human nature *per se;* (2) that much of what people do is pretty "mindless"-they usually don't ask "why" of themselves or others; and (3) the conclusions from attribution research are based on artifact in that since people are not usually aware of why they behave in a given way, they are forced to come up with some answer when the researcher asks them why they did something. (p. 96).

The first criticism has been confirmed through cross-cultural research in attribution. Studies in different cultures have shown different causal attribution patterns in a variety of events, tasks and situations. Although Alcock et al. (1991) consider these criticisms valid, the last two have not been adequately supported by empirical evidence. Despite these criticisms attribution theory continues to find applications to a wide variety of problems in health, education and social psychology.

In summary, the foregoing discussion shows the place of causal attribution in the complex web of issues related to motivation. The hypothesized factors once confirmed will be discussed within the dimensional framework provided by Weiner. The choice of this dimensional framework is grounded on the strong empirical evidence available in the literature and its relevance to the design of the study.

Causal Attributions and Academic Achievement.

The nature of attributions within educational settings has been the focus of a significant amount of research within the attribution literature (Weary, Stanley, & Harvey, 1989). Every educational system has some objectives which are supposed to be achieved through the teaching/learning process that goes on in schools. The extent to which these objectives are being met is assessed through evaluation or testing in various school subjects. Students' performance, which is given in terms of grades, is used for various purposes including placement, revision of instructional methods, certification, selection and promotion. Because evaluation is such an integral part of our educational system, it is important to understand how students react to the feedback they receive about their school work. Perceptions of whether they have succeeded or failed academically, along with analyses of why they rated their performance as such, can have a significant impact on expectancies for future performance, mood, and subsequent academic behavior (Weiner, 1986). It is likely that students make different causal attributions to achievement in different school subjects.

Mathematics is an important subject for most of the post high school training opportunities in Kenya. It is also important for modern technological advancement of any country. However, over the years, there has been persistently poor performance in mathematics especially at the high school level in Kenya (Kenya National Examination Council, 1991).

An investigation of the students' perceptions of their performance in mathematics and their causal attributions to explain it, provides some important information to teachers in designing attribution change programs which have been found to influence students' motivation for achievement in other academic tasks similar to mathematics.

The search for attributions within the realm of achievement behavior typically has involved questions regarding the reasons for success or failure at some academic task (e.g. a set of mathematics problems, a course examination, a semester grade). Further, the majority of research within this domain has examined attribution of academic outcomes to four primary causes: ability, effort, luck and task difficulty (Heider, 1958; Bar-Tal & Darom, 1979; Weiner, Frieze, Kukla, Reed, Rest, & Rosenbaum, 1971). While data from various studies have substantiated the notion that attributions to the four primary causes are the most common in a variety of situations (e.g., Frieze, 1976; Frieze & Snyder, 1980), additional causes such as mood, value of the outcome, and the behavior of others have been cited as important (Elig & Frieze, 1979; Forsyth & McMillan, 1982; Frieze, 1976, Cooper & Good, 1983, Vispoel & Austin, 1991). Instructional strategies, personal organization in doing academic tasks, and the home environment though important factors in determining students' level of performance, have not been well investigated in casual attribution studies. Causal attribution to academic performance has been cited as a contributing factor to the explanation and enhancement of various human attributes including achievement motivation (e.g. Weiner et al., 1971; Kelley, 1967). Appropriate attributions, especially those that are effort-related about success, facilitate achievement by fostering feelings of positive self-worth. Similarly, inappropriate attributional beliefs may interfere with cognitive development by blocking the development of self-worth (Borkowski et al. in press). Recent developments have led to shifts in the focus of both attribution theory and research, with greater emphasis being placed on the taxonomy of causal elements. This new emphasis is reflected in the following statement by Weiner:

> Inasmuch as the list of conceivable causes of success and failure is infinite, it is essential to create a classification scheme or taxonomy of causes. In so doing, similarities and differences are delineated and the underlying properties of the causes are identified. This is an indispensable requirement for the construction of an attributional theory of motivation.(1979, p. 5-6).

Empirical research on perceived causal attribution to academic performance is expected to contribute to the development of an attributional theory of motivation that can be used to devise attribution change programs especially in academic settings.

Causal Attribution and Cultural Experiences

From measurement issues and theoretical distinctions of attributions, it is evident that the specific attributional content used by people can vary from situation to situation. To this must be added the probably obvious point that attributional content also may vary from one culture to another. Studies on the causes and consequences of attribution suggest that various cultural groups emphasize different attributions for success and/or failure. That diversity in language and associated cultural meaning systems can influence the causal inference process, while generally assumed, has not been the focus of widespread empirical inquiry. Given the important role played by attribution in achievement motivation, it is imperative that factors that influence it- such as the culture of the people- need to be investigated.

The term culture has acquired several meanings over the last hundred years. These several meanings reflect different assumptions about human evolution, different foci of interest (such as society, knowledge, and behavior) and different assumptions about epistemology (Goodenough, 1981). The better educated classes of Europe were presumed to be less ignorant than the peasants and to have a greater understanding of the truth and a greater appreciation of the finer things of life. They were "more civilized." The degree to which people differed in their customs, beliefs, and arts from the sophisticated Europeans was a measure of how ignorant and uncivilized they were. In this view, societies did not have discrete cultures but a greater or lesser share in the degree of general culture so far created and developed by mankind as a whole. Societies with the simplest technologies and the least elaborate political order presumably represented the lowest stage of development and Occidental societies represented the most advanced stage. However, at the end of the 19th Century anthropologists and sociologists began to use the word 'culture' to refer to the distinctive body of customs, beliefs, and social institutions that seemed to characterize each separate society (Goodenough, 1981). Instead of different societies having different degrees of culture or different stages of cultural development, each society had a culture of its own, with particular practices, beliefs, and life styles. New members of a community learned that community's culture from their peers, just as they learned its language.

Clark (1984) defined culture as systems of socially transmitted behavior patterns that link human groups to their environmental settings. He conceptualized culture as a system composed of religion, kinship, child rearing and family practices, morals and values, and a community economy. Each culture consists of standards for deciding what can be, standards for deciding how one feels about it, standards for deciding what to do about it and standards for deciding how to go about doing it (Goodenough, 1981). These standards constitute the culture that one attributes to one's peers; no two people from different communities have identical standards for what they regard as their community's culture and the amount of variance they accept in one another's behavior differs from one subject matter to another and from one kind of situation to another.

According to Boone (1985), culture refers to the behavior or way of life of a definable group of people. Culture may be thought of as all the learned and expected ways of life shared by members of a society: artifacts, buildings, tools, and other physical things as well as techniques, social institutions, attitudes, beliefs, motivations and value systems known to the group. This definition shows that culture includes the commonly accepted ways of thinking as well as the more tangible achievements of group life.

According to Goodenough (1970) the simplest and most direct kind of comparison is to look at two cultures with the object of seeing in what ways they are similar or different in content. For example, do the customs of culture A governing the relations between spouses resemble those of culture B? Such comparisons require some set of common terms suitable for describing the content of each culture and some basis for deciding what set of attributes in culture A are the appropriate ones to compare with a particular set of attributes in culture B. The issue can be explored in the comparison of urban and rural members of the same country on a specified attribute such as attribution to performance in a given academic task.

Urbanization, as Shack (1973) has suggested, implies participation in social relations in urban areas and the development of modes of behavior peculiar to urban situations. By extension, this also implies that the particular sociocultural patterns of the urban society affect to a great extent the character and scope of social relationships being expressed very often in political and economic situations. One sociocultural change associated with urbanization is the adoption of the attitudes and behavior norms of Western societies. "Westernization" according to Shack, (1973), denotes changes in individual and group modes of behavior in consequence of adopting Occidental sociocultural norms and values associated with education, technology, language, religion and material goods.

Over the years there has been an influx of western 'culture' to Kenya and to the African countries in general. This is more prevalent in the urban areas where the foreign cultural values and beliefs are eroding the indigenous African values. The western culture propagates an individualistic outlook to events and thus the perception and explanations of these events differ from those of the African people whose culture cherishes collective responsibility. Cooperation is evident in many of the social and economic activities of the rural people. The people in the rural areas continue to uphold some of their traditional beliefs and values.

A common observation should be made here. The experiences gained over time about various events and situations will influence the causal attributions people in the rural areas make about events around them. The same could be said about the people in the urban areas. Thus, it is expected that there will be differential urban versus rural perception and explanation of events. It is hypothesized that students with a rural cultural experience will consider cooperation (referred to herein as personal organization) a more important causal attribution factor in explaining their success than those with an urban experience.

Most parents in Kenya view education in strictly economic terms, that is, as an investment that will be repaid with profits after the graduate obtains a job. Education is also considered a status criterion. The demand for education is especially high in urban areas for at least three reasons as listed by Hanna and Hanna (1981). First, it is likely that aspirations are higher there because young town dwellers have more contacts with modernity than do their rural counterparts. Second, employment opportunities in the towns are visibly better for the educated, whereas in the village or on the farms the opportunity difference is generally less apparent. Third, the educational systems of urban areas have been overburdened because of generally heavy migration to urban centers by people in search of employment and the inability of the urban authorities to provide for essential amenities like schools. Thus, there is stiff competition for places in the available schools.

Aspirations are more realistic in rural Kenya because the distribution of values is more traditionally determined. In the urban areas people are being resocialized to aspire to a higher standard of living. Yet, the economic conditions of life in these centers clearly do not meet the ideals held by most urbanites. Urban opportunities are perceived to be better than those in the rural areas (given a certain level of education). A common belief is that attendance at an urban school, whether primary or secondary, will ensure a better education and enhance one's prospects of obtaining entry to the next level of education. All this will lead rural students to have weaker academic aspirations than urban students which will eventually influence their causal attributions to performance in academic tasks.

Different methods of raising children in different cultures could give a hint of the reasons for student's attitudes at school. There are many global and simplified explanations of cultural practices by different communities which rarely exist in real life. The danger of such generalizations is multiplied in a country with many distinct language groups with each having its own blend of cultural values. However, one common feature of the communities in Kenya is the expectation that rural children will be capable of performing certain tasks when they have reached a certain level of maturity. Whether that level of maturity has been reached is decided by the parents, or other influential persons. Chronological age is only one consideration. Ultimately those around the child believe he/she is capable of learning the required task. It seems that once that decision is made, it is believed that the only thing that retards the child is the child's lack of effort. Thus, if the child fails at a task, the methods to approach it will be explained again with perhaps a verbal or physical reprimand to increase effort. The child will then be expected to complete the task. This cycle of trying, explanation and reprimand, then trying again continues until success is achieved. At the point of success the child is rewarded with praise appropriate to the occasion. This scenario holds true in the rural areas in Kenya to this day where children are forced to repeat classes year after year until they are considered capable of moving to the next class. In the towns perhaps more leniency is shown, but presumably, the same basic principles apply.

Although the upbringing of children in urban areas in Kenya has many similarities to the above, there is at least one distinguishing feature. It is the habit of parents to test a child at something, and then deciding whether to pursue the teaching of that task or not after they have judged whether the child is ready. In fact, the parent may try several times before deciding that the 'time is ripe'. This 'checking' process apparently rarely happens in the rural areas. Thus, a child with an urban cultural experience may well gain the impression that the completion of a task is not dependent only on how hard he/she tries, but also on how difficult it is, whether he/she is clever enough, and perhaps other factors (excuses) which are preferred by the parents for explaining failure. Thus, when faced with academic situations it may be that each group is playing out the norms and values learned in their home environment. Hence, the students in the rural area would be less likely to perceive failure in terms of ability, task, or environment. Upbringing emphasizing effort and the appropriateness of the task in terms of difficulty are more important reasons for success of students in the urban areas.

Whiting (1972) provides another difference in the socialization process between urban and rural children. According to him, the young rural infant rides around on the back of his mother or his siblings while they perform their work in the house, yard or garden. As toddlers they tag along after their siblings who are either working or playing and they always have relatives of all ages around them. In the city the same children are confined in houses and a barren yard. As infants they are often placed on the bed while the mother fusses about the house. In the yard there is little to do and the child spends most of the time watching vehicles and people pass in the street. There are no skills to master. There are none of the animals, plants and activities which are central to the life of rural child. When the young child is desirous of mastering skills, there is less opportunity to observe and imitate the learning techniques adapted to rural life.

Mothers in urban settings (industrial) have compensated for this lack of simulation by introducing toys, books, and other media. They have substituted competence in the manipulation of symbols for the mastery of basic subsistence skills. The rural child's sense of personal worth comes from his realization that he can master adult skills and contribute to the economic welfare of the family. In the city he must develop a new set of skills whose value is less immediately understandable. Furthermore the goals set for the child are more individualistic and not clearly focussed on the shared needs of the family. Children in societies who attend school and do little more than wash dishes, clean and run errands behave less responsibly and are less concerned for the welfare of the family than their peers who grow up in subsistence economies. According to Whiting (1972) these behavior patterns are expected when causal attributions for academic performance are made.

The differences in socialization do have a significant influence on the personality development and perception of events by the child. Thus, there is the need to investigate the existence of relationships between causal attribution factors and different cultural experiences.

Studies on Culture and Causal Attribution

Some causal beliefs are deeply ingrained in the socialization process of a given community and are invoked for a large number of social events. It has been suggested that different ethnic and cultural groups may develop varying cognitive structures supporting different types of causal attribution structures (Katz, 1967). Chandler, Sharma, and Wolt (1983) have reported attributional findings from Eastern, Western and Developing world countries. They found that compared to males, females attributed their achievements less to task factors and more to internal factors. The interaction of country, gender and outcome revealed that Oriental (Chinese) females attributed their success but not failure less to task factors. This position suggests cultural differences in causal beliefs. Fry and Ghosh (1980) showed that Orientals make external attributions for their own success more frequently than Occidentals. According to the study, Occidental subjects took greater personal credit for success and attributed failure to luck, but Oriental subjects assumed more personal responsibility for failure and attributed success to luck. In a study of the impact of Western (U.S) and non-western (India) cultural conceptions on attributional processes, Miller (1984) found significant cultural differences. It is evident from these studies that there exists cultural differences in the way people make attributions on a variety of issues.

In a study by Power and Wagner (1983) on attribution for success and failure of Hispanic and Anglo high school students, significant cultural differences in attribution were also found. Hispanic students, compared to Anglos, were more internal. They attributed their achievement more to ability than did Anglos and they attributed their academic success more to effort and less to luck than did Anglos.

Further, Hispanic students attributed their failure more to lack of ability than did Anglos. According to the attribution framework, Hispanic high school students would be expected to have a more positive self-esteem than Anglos because they have greater attributions of achievement to internal causes. It was also found that Hispanic students attributed their failure to lack of ability. This would be expected to decrease self-esteem. Thus, these findings suggest that the attributional pattern of the Hispanic high school students contains two opposing results which tend to increase and to decrease self-esteem. The contradictory findings could be a result of inadequacies in the measurement techniques that failed to incorporate important variables that influence attributions specifically made by the Hispanic students.

Friend & Neale (1972) examined the effect of racial and social background of students and found that Caucasian children judged ability and effort relatively more important for their performance than task-difficulty and luck, while the reverse was true for the African-Americans. Falbo (1975) studied the achievement attribution of kindergartners coming from middle class families and from families receiving welfare benefits. They reported that middle class subjects chose effort more often as an explanation of outcomes than welfare subjects. This suggests a child's social economic status influences his/her attribution patterns even at a very early age.

Sharma and Tripathi (1986) investigated the relationships among teacher's expectations of the student, caste (low and high) and outcome (failure or success) on an academic task. The sample consisted of 96 males in class VIII in local schools in India. The results indicated that students from high caste and low caste background did not differ in their attribution for success and failure. Also the students about whom teachers had high expectations attributed their success to internal (ability, effort) factors and failure to external (luck, task) categories. However, in the case of students about whom teachers had low expectation, no clear cut trend could be identified.

Studies discussed so far show clearly that we cannot have global explanations for causal attribution that will be acceptable in all situations at all times. Whether students will attribute their perceived performance to internal or external factors is influenced by a variety of personal characteristics and culture-related factors.

Gender Differences in Causal Attributions

One research area that has attracted much attention is gender-related differences in attribution for one's own success or failure. Although the results of these studies have not always been consistent, a number of them have found that males make more egotistical attributions than females. In other words, males tend to make more internal attributions for success and more external attributions for failure than do females. This is the general pattern in a variety of research findings (e.g. Feather & Simon, 1973; Bar-Tal & Frieze, 1977; Dweck, Davison, Nelson & Enna, 1978; Murray & Mednick 1975; Nicholls, 1975; Lochel 1983); males attribute success more internally and failure more externally than do females when they work on academic tasks. One exception seems to be indicated in college students who are both mature and above average in intelligence. Feather and Simon (1973) found a tendency for females to make more internal attributions for success and external attributions for failure than males for their performance on a college exam.

Pertinent to the present study, there is substantial body of evidence to indicate that dysfunctional (i.e.,undesirable) attributional patterns likely to lead to learned helplessness are more prevalent among girls than boys. Wolleat, Pedro, Becker and Fennema (1980) reported findings of sex differences in the attributional patterns for success and failure in mathematics. In their sample of over 1200 high school students, success was attributed to ability more frequently by males than females. Females were more likely than males to attribute success in mathematics to an unstable factor (effort), but failure to stable factors (ability, task difficulty). Even when their performances on a mathematics achievement test were similar, the strengths of their attributions differed.

In a study done in Australia using 94 (48 males, 46 females) secondary school students, significant differences were found between males' and females' attributions to performance in mathematics (Leder, 1984). The measure used was the Mathematics Attribution Scale (MAS) (Wolleat, et al., 1980). The MAS contains eight subscales of four items each. The subscales are designed to measure success and failure attributions with respect to ability, environment, effort and task (mathematics problems). The following results were reported:

a) At every level of achievement the boys attributed success in mathematics to ability more strongly than did the girls, while at every level of achievement the girls attributed failure in mathematics more strongly to ability than the boys.

b) The mathematically capable boys (in terms of their achievement in class) attributed success in mathematics more strongly to task and less strongly to effort than did the mathematically capable girls.

c) The mathematically capable girls (in case of failure) tended to attribute their failure in mathematics more strongly than the boys not only to ability but also to effort and task.

It can be seen that in general the attributional patterns of success and failure in mathematics of the boys and particularly of the mathematically achieving boys tended to be more functional (i.e., desirable) than those of the girls (particularly the mathematically achieving ones). Dweck (1977) has argued that teachers may unwittingly be contributing to the different attributional patterns of boys and girls because of the way they interact with their male and female students. This may be in the form of motivational strategies employed by the teacher, for example, statements that portray mathematics as a "boys' subject". Weiner (1980) has also stressed the importance of teacher-student interactions in reinforcing functional or dysfunctional attributional patterns.

Misra and Misra (1986) studied gender differences in achievement attributions by socially disadvantaged students on a school examination. The subjects were 80 (40 males and 40 females) first year intermediate students from two colleges in the city of Allahabad in India. Achievement outcome was determined on the basis of examination marks as well as performance ratings by teachers on a 5-point scale. Attribution was measured by students rating the perceived contribution of four factors towards their performance in the examination using a 5-point scale. The four factors were mental ability, luck, preparation for exam at home, and difficulty level of courses of studies. The results indicated that successful girls tended to show greater attribution for their performance to external causes such as luck and task difficulty than successful males. The findings corroborate the earlier studies done in other cultural settings (Weiner, 1979, 1980b). Performance in school examinations is personally significant because it is relevant to the professional career of the individual. However, due to differences in socialization and role expectations, attainment in school has varying degrees of significance for boys and girls.

Clarkson (1983), in a study entitled "Papua New Guinean Students' Causal Attributions for Success and Failure in Mathematics," reported no significant sex differences in the patterns of attribution. One of the aims of the study was to compare the males' and females' causal attributions for success and failure in mathematics. The sample consisted of subjects from year six level (n=90), year seven level (n=51) and year nine level (n=65), all from three schools from the city of Lae, Papua New Guinea. The sample of students contained a good mix of representatives from the many different cultural groups which make up the peoples of the country. The instrument used for this study to measure causal attribution choices was a modified version of the Mathematics Effort Attribution Scale (MEAS) initially developed by Relich (1981). The results indicated no significant sex differences between any of the means for the subscales (ability, effort, task, and environment) in both success and failure conditions at any year level. This is in marked contrast to results from western countries. Students at the different year levels showed different causal attributions both for success and failure conditions.

The pattern could partly be explained in terms of the change of perceptions in a direction which indicates western acculturation of the students.

Two factors, one cognitive and one motivational, may account for the tendency for males to make more egotistical attributions than females. The cognitive factor is how well the males and females expect to do on some tasks. People with low expectancies for success tend to attribute success less internally and failure less externally than people who have higher expectancies for success. Research findings show that females have lower expectancies for success than males and this may account for their tendency to make less egotistical attributions than males (Feather, 1969; Feather & Simon, 1973).

The motivational factor that could account for the sex differences in attributions is the different degrees of ego-involvement that males and females may have in a given task. When the task involves competition or intelligence, the competencies are considered to be part of the masculine stereotype (Broverman, Vogel, Clarkson, & Rosenkrantz, 1972). It would be expected that males should be more motivated to take credit for success and deny blame for failure than females in such tasks. On masculine tasks, males make more internal attributions for success and more external attributions for failure than do females.

In summary, on tasks which are thought to involve "masculine" characteristics, males should attribute success more internally and failure more externally than females. This is because males should have higher expectancies of success and greater ego-involvement in these tasks than females. However, on tasks in which females have higher expectancies of success or greater ego-involvement than males (i.e., tasks which involve "feminine" characteristics), males should attribute success less internally and failure less externally than females. In Kenya, the performance by high school girls in mathematics compared to that of boys has been generally poor. One reason given for this is the negative attitude girls have towards mathematics. In one study done in Kenya to investigate the attitude of high school students towards mathematics, Okech (1986) found that girls consider the subject as a "boys' subject", and have generally a negative attitude towards mathematics. This in effect influences the amount of effort the girls put in the learning of mathematics and hence their overall performance.

Gender differences cannot be ignored in a study that involves both males and females especially on causal attributions to academic performance. It is proposed that males and females will differ in the way they make causal attributions to their performance (success/failure) in mathematics. Due to different socialization processes, especially in role prescription for males and females, males will attribute success to more internal causes and failure to more external causes than will females.

Measurement of Causal Attributions

Adequate testing of any scientific theory is clearly dependent on the satisfactory measurement of its key theoretical concepts. It has been realized that measurement tools have not kept pace with advancement in attribution research. In fact, the issue of how causal beliefs should best be measured has no satisfactory answer (Elig & Frieze, 1979). Researchers in the past have varied in their selection and use of various measurement techniques of attributions and related theoretical constructs. According to Weary et al. (1989), a number of techniques have been used in attribution research. These include:

a) Open-ended measures - subjects list what they believe to be the cause or causes of an event, and then the investigator classifies the subjects' attributions as ability attributions, effort attributions, or other relevant categories of causal factors;

b) Independent ratings - subjects rate the importance of specified causes of a given event;

c) Percentage of causality measures - sometimes called the ipsative measures, because the assignment of a percentage to one cause of the event determines the percentage given to the other specified causes;

d) Choice of one major cause of an event;

e) Bipolar ratings - two possible causes of events, ability and luck, for example, anchor the end-points of the scale.

One major distinction among these measures is whether the potential causes for the event are specified on some a priori basis, for example, theoretical considerations, by the investigator, or are generated by subjects. Each of these techniques has its own advantages and disadvantages in terms of practical considerations. Rating scales have a methodological advantage in that such scales are considered to have interval properties, thus allowing for the use of parametric tests. Over-reliance on this approach, however, has led to the relative neglect of the ways in which people normally explain the causes of events. Content analysis of open-ended responses has provided some answer to the criticisms. Although respondents might find open-ended questions easier and more natural to respond to, they are psychometrically inferior in terms of their validity and reliability.

However, not much is known about the implication of using one attribution measure over the other.

In perhaps the most comprehensive examination of measurement issues in attribution, Elig and Frieze (1979) evaluated three different methods of assessing causal attributions: open-ended responses, percentage ratings, and independent ratings of importance. In this study, college students made attributions on all three measures for their success or failure on an academic task. The measures were then evaluated in terms of how reliable (repeatable) and valid (factorial validity) they were. Open-ended measures of causal attribution had poorer inter-test validity and reliability than structured response measures. Rating scale methods had both good inter-method correlations with the percentage measures and good face validity. Elig and Frieze concluded from their analyses that the independent ratings measures were more reliable and valid than were the percentage or open-ended methods of assessing causal attributions. Although they recommended use of the independent scales in settings where the potential causal factors are relatively well-understood (e.g., achievement settings), the value of open-ended measures should not be underplayed. Such measures may be important especially at the pilot stage of research and are essential when one attempts to study causal attribution in novel situations (Elig & Frieze, 1979).

Independent ratings in Likert Scale format were employed in this study to assess students perceived causal attributions to performance in mathematics. However, open-ended measures were used as one source of items during the pilot stage and for validation purposes.

Assessment of Dimensions of Causal Attribution Factors

Through numerous studies, various dimensions of causal attribution based on such factors as ability, task difficulty, effort, and luck have been identified. The dimensions range from the original one dimensional locus of control classification of causality proposed by Rotter (1966), to the presently known three dimensions of locus of control, stability and controllability (or intentionality) proposed by Weiner (1979). In most of these studies the instruments used to assess attribution have been constructed based on the four causes proposed by Heider (1958).

The methods used to assess perceived causal attributions factors are also used in assessing causal dimensions. The investigator often translates specific attributions made by subjects into some factors based on the theoretical meaning of the cause. For example, if a subject attributes his or her success on a class examination to high ability, the investigator would classify this specific attribution as internal to the subject and as stable or invariant over time (Weiner, 1972). Alternatively, researchers may directly ask subjects for their perceptions of the causes of a given event along some specified causal factors. In the present study, Weiner's scheme of dimensions will be used in the interpretation and discussion of the results.

Russel, McAuley, and Tarico (1987) compared the reliability and validity of three different measures of causal attribution. First, subjects were asked to indicate on the Causal Dimension Scale (Russell, 1982) their perceptions of the causes of their examination performance in terms of the locus of causality (internal-external), stability, and controllability dimensions. As reviewed, these are among the dimensions identified in previous research to be important in achievement-related settings. Second, subjects' attributions were coded by judges along the three attributional dimensions. The third method entailed asking subjects to rate the importance of a number of specified potential causal factors to their exam performance. These were classified on theoretical grounds as representing one end of the three dimensions of locus of causality, stability, and controllability. The results of this study provided support for directly assessing how subjects perceive the causes they cite for their achievement outcome. While both the open-ended measure and the Causal Dimension Scale proved to be reliable methods, the latter was the most valid.

Summary

There is both theoretical and empirical evidence that perceived causal attribution has significant influence on a variety of human attributes including achievement motivation. It is also clear that variables such as gender and cultural experience of a student influence his/her manner of making attributions to academic performance in a number of ways. Emerging from the literature review are the following questions which are the focus of this study:

a) Will the hypothesized causal attribution factors: instructional strategy, ability, personal organization, effort, state of health, and home environment, be rated significantly by students in making their causal attribution to perceived performance in mathematics?

b) Does the gender of the student influence the pattern of making causal attribution to perceived performance in mathematics? Specifically do males attribute their success more to internal factors and failure more to external factors than females students?

c) Does cultural experience (urban/rural) of the student affect the ratings of the causal attribution factors for perceived performance in mathematics? Specifically, do students with an urban cultural experience attribute their success more to internal factors and failure more to external factors than students with a rural cultural experience?

d) Are there differential school effects in the ratings by high school students of the causal attribution factors to perceived performance in mathematics?

The design of the study, description of the study population and sample, discussion of the data collection instruments and the statistical procedures to be used in the analysis of data are presented in the next chapter.

III. Methods and Procedures

Introduction

The methods and procedures used for this investigation are presented in this chapter. The chapter is comprised of six sections: the first section discusses the research design considered appropriate for the study, while in section two and three a description of the instrument and results of a pilot study using this instrument are provided respectively. Section four provides a description of the target population. Selection and description of the sample is presented in section five. Some of the statistical techniques used in analyzing the data are discussed in the last section.

Research Design

Once the problem to be studied was identified and clarified, a design was selected in accordance with the following observation by Kerlinger (1986):

> Research designs are invented to enable the researcher to answer research questions as validly, objectively, accurately and economically as possible. Any research plan is deliberately and specifically conceived and executed to bring empirical evidence to bear on the research problem. (p. 280)

The central purpose of a research design is to maximize the informativeness of results by minimizing the number of plausible explanations for them.

A causal-comparative research design, also referred to as *ex post facto* , was utilized. Causal-comparative research is used when investigators are not in a position to test a hypothesis by assigning subjects to different conditions in which they directly manipulate the independent variable. Kerlinger (1986) defines the causal-comparative research design as

> ...a systematic empirical inquiry in which the scientist does not have direct control of the variables because they are inherently not manipulable. Inferences about relationships among the variables are made, without direct intervention from concomitant variations among them. (p. 279).

In causal-comparative research the changes in the independent variables have already taken place and therefore the researcher has no control over them. They must be studied retrospectively for their possible effects on an observed dependent variable. That is, the researcher starts from an effect and works backwards in time in order to identify causal elements.

The choice of this design was justified on the grounds that this study was not just for collecting and describing data but it was also investigating and attempting to establish the existence of certain relationships among variables.

This design was considered appropriate because its use in research of this type has been strongly supported. According to Kerlinger (1986), much causal-comparative research must be done in psychology, sociology and education simply because many research problems in the social sciences do not lend themselves to experimental inquiry. Borg and Gall (1989) give the major advantage of causal-comparative research designs as "they allow us to study cause-and-effect relationships under conditions where experimental manipulation is difficult or impossible. Further, many such relationships can be studied in a single research project" (p. 537). The major weaknesses of this design are the inability to manipulate the independent variables and lack of control of the extraneous variables.

Instrumentation

A review of the literature on the measurement of causal attributions reveals that there is no one standard instrument that can be used to measure attribution for a variety of tasks and situations. Those that have been used in assessing causal attributions for mathematics performance have ignored some components of attribution (e.g., home environment and instructional strategies), that were studied in the investigation. Thus the first phase of the study was devoted to the construction of a questionnaire for assessing the following perceived causal attribution factors to performance in mathematics: instructional strategy, ability, effort, personal organization, state of health and home environment.

Part one of the questionnaire consisted of statements seeking biographical and demographic information about the subjects such as gender and school location. The second part comprised statements about the possible reasons used to explain the causes of performance in mathematics. The items were drawn from the literature on causal attribution and the investigator's experience as a mathematics teacher and his familiarity with the culture of the students studied. Also, expert information on attribution was obtained from professionals including high school teachers, administrators and university professors. Student's responses to an open-ended questionnaire in a pilot study provided additional information.

After defining the construct and developing an initial pool of items that represented the construct, the next step to develop the scale was to select those items that gave the maximum possible inter-item homogeneity. Ideally, criterion measures should be obtained independently of the instrument being developed. Since external criterion measures having acceptable reliability are rarely obtainable, recourse is generally taken to an internal criterion- the scores on the test itself. When the criterion is internal, the inter-item homogeneity can be accomplished through multivariate analysis of the responses to the items constituting the scale criterion so that the items which detract from the homogeneity of the scale are excluded and those which contribute to it are selected. To accomplish this objective a pilot study using a small number of subjects from the population was carried out. Results of the pilot study are given and discussed in the next section.

Results of a Pilot Study

A sample of 64 students drawn from one school in a rural area (n=37) and one from the City of Nairobi (n=27) was used for the pilot study. Two parallel form scales consisting of 50 items each drawn from an initial pool of 90 items were used. Both were in Likert scale format on a 5-point scale ranging from strongly agree to strongly disagree. An open-ended questionnaire was also administered. This required the students to list as many causes as they could think of that they thought were responsible for their success and/or failure in mathematics. The open-ended questionnaire was intended to provide additional information that may not have been covered by the initial scales.

Item analysis for the items in part two of the questionnaire was carried out using LERTAP program written for the Laboratory of Educational Research of the University of Colorado and available in the Center for Research in Applied

Measurement and Evaluation (CRAME) at the University of Alberta. This provided indices for internal consistency, variability of responses and the correlations between each item and total score found by the remaining items in the corresponding scale. These indices provided information on how consistent the items were in measuring causal attributions assessed by the scale. Measures of internal consistency were used to establish both convergent and divergent validity of the items.

Items that had low correlations with the total scale were deleted. Others that seemed ambiguous were modified for clarity. A final scale with an internal consistency of 0.85 (mean=2.6, Sd=1.4) was obtained including the items in the parallel form scales. Similar items appearing in the two scales were included only once in the final scale. An additional five items were obtained after content analysis of the open-ended questionnaire. These items were constructed based on the causes that appeared to have been left out of the initial scale, but which were indicated most frequently by the respondents. Thus, a scale of 35 items was obtained whose construct validity and reliability was to be investigated in the main study. Each rating was treated as the score for the particular item, which then formed the basis of the statistical analyses.

Although the Likert scale was expected to be appropriate for both those who perceived their performance as failure and those who perceived it as successful, this was found not to be the case. After indicating that they perceived their performance as successful, some subjects responded to the items as though they had perceived their performance as failure. For clarity, two scales were constructed, both containing the same items but differently structured for those in the failure category (section B1) and those in the success category (section B2) (refer to Appendix A).

Identification of the Target Population

The target population was all the form four students in the city of Nairobi and the rural district of Machakos, all in Kenya during the year 1992. These were students who have had four years of secondary education in addition to the eight years of primary education. The national examination that is taken at this level determines whether one is to join the national universities or not. For this reason it is an examination that is considered important by parents, students, and the community at large. It determines students' future academic prospects. The regions named above were purposely selected in order to provide a population that would enable the researcher to investigate the variables for the study and be able to generalize to the wider population of all the high school students in Kenya. The city of Nairobi was included to make the study of the urban versus rural comparisons possible. The rural district of Machakos has the highest number of high schools of all types in Kenya and therefore provided a fair representation of the rural population of high school students in the country.

Sample Selection

The data for this study were collected in Kenya in the late 1992. The subjects in the selected sample consisted of 350 students, all in their final year of secondary education. Their average age was eighteen years. They included students from the whole cross-section of schools in Kenya. The selected students had done all their schooling in either urban or rural area. In order to have a sample that minimizes extraneous variables, only day schools were considered in this study. These are the schools that do not provide accommodation to their students and as such only students from the immediate surroundings attend them. This puts them in constant contact with the immediate communities and therefore presents an advantage to studying cultural differences.

A two stage stratified sampling procedure was used. In the first stage the selection of the schools was stratified by region. Six school were randomly selected from the urban area and four schools were randomly selected from the rural areas. In the second stage, one form four class per selected school with an average of thirty five students was selected at random, giving a sample of about 350 students for the study. All the students in the selected class were included in the sample. The students then responded to the Causal Attribution Scale on perceived performance in mathematics in the mid-year trial examination (KSCE Mock). This is an examination which is supposed to be similar to the national examination taken at the end of the year but is organized on a district basis. Since the examinations in the districts are set with the standards of the national examination in mind, they are not expected to be different in terms of content coverage, type of the test items and the difficulty level.

The average time spent on the questionnaire by each subject was about 40 minutes. Of the 350 questionnaires returned nine had some important information missing and were not included in the analysis.

Data Analysis Statistical Procedures

Descriptive statistics were used to describe the variables in the study and to lay a basis for testing the proposed hypotheses. Some of the statistical techniques used in the data analysis are discussed next.

Three-Way Analysis of Variance

The analysis of variance is a technique for studying the relationship between a dependent variable and one or more independent variables. The independent variables in the analysis of variance are usually referred to as factors and are categorical variables, for example, gender and region. The dependent variable is a numerical variable, for example, mathematics scores and the ratings of the causal attribution factors. A three-way analysis of variance as is used in this study has three independent variables namely gender (male/female), region (urban/rural) and perceived performance (success/failure). In the analysis of variance the scores obtained by the subjects on a variable are assumed to be independent. This assumption is rarely met in studies that use school data where students are not randomly assigned to classes or schools. However, the technique is appropriate as a preliminary procedure in testing relationships and differences among variables in data obtained from schools.

Confirmatory Factor Analysis

Initially, confirmatory factor analytic techniques were applied to the student's responses on the causal attribution scale to establish the existence of six causal attribution factors proposed in the study. The proposed factors are: ability, personal organization, practice (effort), state of health, home environment, and instructional strategies. The sum of the scores of the items having large loadings on each factor were standardized and used for analyses with respect to the following variables: gender of the subject, cultural experience, perceived performance and expected performance.

Confirmatory factor analysis tests the likelihood that a specified form of a factor pattern matrix could arise from the observed data. This procedure differs from exploratory factor analysis because explicit hypotheses are tested. One procedure used commonly in confirmatory factor analysis is the maximum likelihood approach (ML). Despite its relative restrictive set of assumptions, ML factor analysis provides an important advantage over the other factor extraction procedures. For example, factor loadings estimated through ML procedures are close estimates of the relationships among the variables in the population at large (Harman, 1976; Nunnally, 1978).

The central concern in the maximum likelihood approach is to estimate the population parameters from sample statistics. For the procedure to maximize the likelihood function, the method of estimating the population parameters must have the following characteristics:

a) Maximum likelihood estimates will converge to the population parameter as the size of the sample increases towards that of the population.

b) The estimated parameters will be the most consistent with the smallest variance across samples.

In maximum likelihood factor analysis the information provided by the correlation matrix is used to obtain the best maximum likelihood estimates of the factor loadings and uniquenesses needed to reproduce the population correlation matrix. The ML procedure does not uniquely locate the factors. Given a specified number of factors, there are infinite number of positions to which the factors could be rotated that would satisfy the likelihood function. All these solutions would give the same estimated reproduced correlation matrix. The selection of one of the solutions is based on the interpretability of the factors.

The variables are also assumed to have a multivariate normal distribution. However, Monte Carlo studies of the robustness of maximum likelihood estimation procedure indicate that with large sample size (N=200), the procedure is relatively insensitive to departure from normality (Fuller & Hemmerle, 1966). The maximum likelihood has been developed only in terms of large sample estimates. Competing theories can always exist to explain the same observed data. Arguments between the theories can only be resolved on the basis of new empirical data.

Hierarchical Linear Modelling (HLM)

Social systems and education in particular typically have a hierarchical organization in which 'units' at one 'level' are grouped within units at the next higher level. For example, students (level-1 units) are grouped in classrooms (level-2 units) and classrooms are nested within schools (level-3 units). For this study, perceived causal attributions were expected to be influenced by the characteristics of the students themselves, their school, and their cultural experience (urban/rural). Since student characteristics vary within schools and school characteristics vary between schools, questions about school effects and certain student characteristics require simultaneous exploration of relationships at the within and between school levels. Early school effects research relied primarily on single-level multiple regression models at either the student level or the school level to assess school effects, and therefore failed to adequately model the multilevel structure of these relationships. Treating these data as if they were all at the same unit of analysis has led researchers to misleading conclusions about the effect (or non-effect) of various aspects of the school environment on student attributes. Thus the Hierarchical Linear Modelling (HLM) approach was considered the most relevant analytic technique for this study.

The school-level variables included region (rural/urban), average school performance, average mathematics performance and average SES, while the student-level variables were sex, actual mathematics performance, perceived performance, expected performance and the six hypothesized causal attribution factors. The HLM approach allows for explicit modeling of effects at the various levels of the hierarchy so that all estimated effects are adjusted for the individual level and group levels' influences on the dependent variables (Bryk & Raudenbush, 1989).

HLM is a regression-like technique that addresses the problem of students nested within schools in the following way. Using a sample of schools with a sample of students in a particular grade within each school, a student-level linear regression model is estimated for each school to predict the association of some student characteristics with say student's measure of performance at that grade. Simultaneously, at the school level a regression model is defined using school characteristics to estimate the parameters obtained at the student level. A frequently used model is to estimate the within school intercept and regression slopes. The two basic equations for a HLM model are:

Student level $Y_{ij} = X_{ij}\beta_j + r_{ij}$ $r_{ij} \sim N(0, \sigma^2 I)$,

School level $\beta_j = W_j\gamma + u_j$ $u_j \sim N(0, T)$,

where:

Y_{ij} is a n_j x 1 vector of outcomes,

$i=1,\ldots, n_j$ for j^{th} school,

X_{ij} is a n_j x $(q + 1)$ matrix of predictor variables,

β_j is a $(q + 1)$ x 1 vector of the unknown parameters,

I is a n_j x n_j identity matrix,

r_{ij} is a n_j x 1 vector of errors,

W_j is a $(q + 1)$ x p matrix of predictors for school j,

γ is a p x 1 vector of fixed effect coefficients,

u_j is a $(q + 1)$ x 1 vector of school level random effects (or errors),

T is a $(q + 1)$ x $(q + 1)$ residual variance - covariance matrix,

n_j is the size of school j,

q is the number of predictors at the student level, and

p is the number of predictors at the school level.

Separate estimates are produced for the variance within schools and the variance between schools. Conceptually, HLM consists of estimating regressions of regression results, except that the equations at each level are estimated at the same time or iteratively and the variance at one level is taken into account in estimating the next level. For a three-level HLM model, regression equations would be estimated within classrooms, classroom-level regressions would be estimated within schools to predict the student-level results, and school-level equations would be estimated to predict the classroom-level results.

By correctly modeling within- and between-school variation in a set of given student-level variables, HLM models allow an explanation of the variables as a function of school-level effects. In this way, it directly models the hierarchical nature of the data. In addition, HLM allows the examination of the correlation of school characteristics with the between student characteristics.

The results of data analysis and testing of the postulated hypotheses are presented in the next chapter.

IV. RESULTS

Introduction

The results of the data analysis are presented in this chapter. Descriptive statistics for the main variables used in the study are first given to lay a foundation for the testing of the research hypotheses. Results of item analyses of the Causal Attribution Scale are presented next, followed by a validation process of the causal attribution factors using confirmatory factor analysis. Finally, tests of the hypotheses using analysis of variance and hierarchical linear modeling are given.

The purpose of the study was to determine the relationships existing between school characteristics, students' characteristics, and the perceived causal attribution factors of: Instructional Strategies, Ability, Personal Organization, Effort, State of Health, and Home Environment. The school characteristics considered included Region (rural/urban), and Mean Social Economic Status (MNSES). Student characteristics studied included; Gender (male/female), Perceived Performance (PERPER) (success/failure), Mathematics Score (MATSC), Expected Performance (EXPP), Value of School (VALSC). Each of the last three variables and MNSES was measured on a 4-point scale (1-Low, 2-Moderate, 3-High and 4-Very High).

A total of ten schools participated in the study, six were from the rural region while four were from the urban. Only one class per school was selected in order to control for variation across classes in a given school. Apart from the information collected through the questionnaire, other relevant information was obtained from the students' personal files. The information included socio-economic status and students average grade in all subjects.

Descriptive Statistics of the Main Variables.

The distribution of students by Gender, Region and Perceived Performance in the whole sample is shown in Table 1. As reported, 57.8% of the students were from schools in the rural area while the rest were from the urban area. There were more male (60.1%) than female students. Only 20.5% of the total number of students perceived their performance as a success with 90.0% being males.

Table 1

Distribution of Students by Region, Gender, and Perceived Performance

	Region				
	Urban		Rural		
PERPER	Male	Female	Male	Female	Total
Success	31	3	32	4	70
					20.5%
Failure	39	71	103	58	271
					79.5%
Total	70	74	135	62	341
	20.5%	21.7%	39.6%	18.2%	100%

The means and standard deviations of Mathematics Scores (MATSC), Expected Performance (EXPP), Social Economic Status (SES) and Value of School

(VALSC) distributed according to Region, Gender and Perceived performance are reported in Table 2.

Table 2

Means and Standard Deviations of Students' Characteristics Variables by Gender, Perceived Performance and Region

	Male				Female			
	Success		Failure		Success		Failure	
Variable	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
N	31	32	39	103	3	4	71	58
MATSC								
Mean	2.87	1.47	1.31	1.12	3.00	1.50	1.18	1.04
Std	.85	.67	.57	.32	1.00	.58	.43	.18
EXPP								
Mean	3.45	2.91	2.46	2.31	3.67	3.00	1.90	2.00
Std	.99	.96	.97	.93	.58	.82	.78	.90
VALSC								
Mean	2.84	2.78	2.64	2.68	3.00	3.00	2.90	2.72
Std	.45	.61	.63	.56	.00	.00	.30	.59
SES								
Mean	1.84	1.44	2.05	1.39	3.67	1.25	3.47	1.45
Std	.74	.67	.92	.65	.58	.50	.71	.80

MATSC- Mathematics Scores

EXPP- Expected Performance

VALSC- Value of School and SES- Social Economic Status

It is evident in Table 2 that mathematics was a poorly performed subject by students from the rural compared to those from the urban region. Students who perceived their performance as successful did relatively better than those who perceived it as a failure. Majority of the students had moderate expectations of doing well in the subject and attached high value to attending high school.

Comparison of Students' Characteristic Variables by Gender, Perceived Performance and Region

To investigate the existence of differences among students in their Mathematics Scores, Expected Performance, Socio Economic Status and Value of School with respect to Region, Gender and Perceived Performance, Three-Way Analysis of Variance (ANOVA) was used. The results appearing in Table 3 to Table 6 show that statistically significant differences existed between urban and rural students in Mathematics Scores ($F=64.618$, $p \leq .01$) and Socio-Economic Status (SES) ($F=79.300$, $p \leq .01$). The urban students had generally higher mean scores than rural students in all the variables except in Socio-Economic Status. Significant differences existed between males and females in SES ($F=25.444$, $p \leq .01$).

Table 3

Three-Way ANOVA Results for MATSC by Gender, PERPER and Region

Source of Variation	Df	Mean Square	F	p
Gender	1	.003	.013	.909
PERPER	1	24.698	108.342	<.001
Region	1	14.731	64.618	<.001
Gender x PERPER	1	.189	.828	.364
Gender x Region	1	.004	.019	.891
PERPER x Region	1	9.202	40.367	<.001
3-Way Interaction	1	.028	.121	.728
Residual	333	.228		

Table 4

Three-Way ANOVA Results for EXPP by Gender, PERPER and Region.

Source of Variation	Df	Mean Square	F	p
Gender	1	.443	.540	.463
PERPER	1	26.531	32.347	<.001
Region	1	2.240	2.731	.099
Gender x PERPER	1	1.950	2.378	.124
Gender x Region	1	.023	.028	.867
PERPER x Region	1	1.885	2.298	.130
3-Way Interaction	1	.193	.235	.628
Residual	333	.820		

Table 5

Three-Way ANOVA Results for VALSC by Gender, PERPER and Region

Source of Variation	Df	Mean Square	F	p
Gender	1	.658	2.407	.122
PERPER	1	.636	2.329	.128
Region	1	.054	.197	.657
Gender x PERPER	1	.008	.029	.865
Gender x Region	1	.035	.129	.720
PERPER x Region	1	.009	.034	.854
3-Way Interaction	1	.105	.383	.536
Residual	333	.273		

Table 6

Three-Way ANOVA Results for SES by Gender, PERPER and Region

Source of Variation	Df	Mean Square	F	p
Gender	1	13.589	25.444	<.001
PERPER	1	.036	.067	.796
Region	1	42.354	79.300	<.001
Gender x PERPER	1	.039	.073	.787
Gender x Region	1	15.908	29.784	<.001
PERPER x Region	1	.027	.050	.823
3-Way Interaction	1	.614	1.150	.284
Residual	333	.534		

The ANOVA results also indicate that significant differences existed between those students who perceived their performance as successful and those who perceived their performance as failure in the following variables: Mathematics score ($F=108.342$, $p \leq .01$) and Expected Performance ($F=32.347$, $p \leq .01$). However, no significant differences were identified with respect to SES ($F=.067$, $p > .05$) and Value of School ($F=2.329$, $p > .05$).

There was a significant interaction between Region and Gender in SES (29.784, $\leq .01$). The urban females had the highest mean rating in SES followed by urban males, and rural females had the least rating on this variable. The interaction between perceived performance and region was also significant with respect to mathematics scores. The mean scores in mathematics for the urban students who perceived their performance as success was highest, while the rural students who perceived their performance as failure had the lowest mean score. All groups had similar ratings for value of school regardless of their perceived performance and region.

Item Analysis of the Causal Attribution Scale

Item analysis was done in two stages. First, for the whole scale of 35 items, and then for the six subscales after factor analysis. The first stage was used to identify the items which were functioning well in measuring the causal attribution factors hypothesized in the study. This was done by comparing the correlations of all the items with the total scale and with the external criteria of gender and cultural experience (Region). The two external criterion variables were included to assess any bias in the responses that could be due to them. Of the 35 items initially used five had very low correlation coefficients with the total scale and were therefore left out in subsequent analyses.

Internal consistency for the whole scale was 0.90 (mean=2.44, Sd=1.72) which is sufficiently high for practical purposes. Confirmatory factor analysis was done using maximum likelihood extraction procedure on the resulting 30 items.

Confirmatory Factor Analysis Results

Six factors of causal attribution as hypothesized in the literature were confirmed through confirmatory factor analysis. First the variables were allowed to load on the possible maximum number of factors using the maximum likelihood extraction procedure. This gave a total of seven factors. Secondly, the number of factors was set to six and maximum likelihood extraction carried out again. Both the seven factor solution and the six factor solution were rotated using both orthogonal and oblique procedures. The six factor solution could be meaningfully interpreted as compared to the seven factor solution. Thus the six factor solution was considered appropriate for the data and was used for subsequent analysis.

Loadings ranged from 0.30 to 0.83. Item loadings for the various factors identified were guided by the following set of decision rules:

1) the minimum value for retaining an item on a factor was 0.30
2) an item was retained only if it loaded primarily on one factor
3) an item was retained on the factor on which its loading was greatest.

Of the thirty items entered for factor analysis four did not meet the criteria stipulated above and were left out in the proceeding analysis.

The six factor solution was subjected to both varimax and oblimin rotations. The factors being measures of social-psychological constructs were expected to be correlated and therefore the oblimin factor pattern was selected for interpretation. The factor analysis procedure available in the SPSS program does not provide the total contribution of the factors to the variance of the variables especially when the factors are correlated because it ignores the joint contribution of the factors. Since the factors were correlated their contributions to the variances of the variables come about through their interaction with other factors as well as through their individual impact (Harman, 1960). Thus the total contribution over all the variables is the sum of the total direct and total joint contributions. The total contribution was computed using an APL Function. The factor loadings and the factor- correlation coefficients from the SPSS factor analysis results were used as input data in the APL program.

Table 7 summarizes the results of factor pattern loadings for the final six-factor oblique solution, while an item location index for the six-factor solution of the scale showing item numbers comprising each subscale is provided in Table 8.

Table 7

Factor Loadings of the Six-Factor Oblique Solution.

Item	I	II	III	IV	V	VI	h^2
VAR21	.793						.665
VAR41	.752						.609
VAR30	.749						.749
VAR22	.741						.655
VAR16	.621						.519
VAR13	.506						.660
VAR18		.831					.697
VAR17		.746					.626
VAR9		.423					.462
VAR34		.390					.489
VAR25			.740				.567
VAR31			.727				.585
VAR43			.300				.606
VAR37				.766			.609
VAR40				.755			.566
VAR19				.555			.411
VAR42				.368			.416
VAR20					.729		.598
VAR32					.703		.628
VAR23					.640		.577
VAR14						.616	.509
VAR28						.611	.509
VAR15						.600	.442
VAR11						.583	.632
VAR24						.494	.491
VAR35						.425	.509
Variance	13.0%	7.0%	6.7%	7.0%	7.3%	11.2%	52.2%

Table 8

Item Location Index for the Six Causal Attribution Factors

1) FACT1	Instructional Strategies.
VAR30	Like the teacher.
VAR21	Understand teacher's method of teaching.
VAR22	Was liked by the teacher as an individual.
VAR41	Teacher was responsible for my performance.
VAR16	Understood teacher's notes.
VAR13	Interested in mathematics.
2) FACT2	Ability.
VAR18	Because of other student's skills.
VAR17	Because of other student's ability.
VAR34	Cooperation with other students.
VAR9	My skills in mathematics.
3) FACT3	Personal Organization.
VAR25	Time allowed for the exam.
VAR31	Time allowed for revision.
VAR43	Perceived importance of mathematics.
4) FACT4	Effort.
VAR37	My effort in studying mathematics.
VAR40	I am responsible for the performance.
VAR19	Amount of practice for the exam.
VAR42	Because of practice with others.
5) FACT5	State of Health.
VAR32	State of health at the time of the exam.
VAR20	Mood at the time of the exam.
VAR23	Luck at the time of the exam.
6) FACT6	Home Environment
VAR11	Usefulness of mathematics outside school.
VAR14	Parental encouragement to study mathematics.
VAR15	Family interested in mathematics.
VAR28	Home conducive for doing mathematics.

Table 8 continued

VAR24	Interest in mathematics.
VAR35	Effect of my family role on performance.

The six-factor solution that was obtained accounted for 52.2% of the scale variance. The first factor which accounted for 13.0% of the scale variance was labeled Instructional Strategy employed by the teacher. The second factor which accounted for 7% of the total variance was labeled Ability. Factor three was labeled Personal Organization and accounted for 4.5% of the variance. The fourth factor was labeled Practice (or Effort) while the fifth and sixth factor were labeled State of Health and Home Environment accounting for 6.7% 7.0% and 11.2% of the variance respectively.

Scores for each factor were obtained by summing all the items loading on each factor and converting it to a percentage of the total score of that subscale. The results of the confirmatory factor analysis also provided evidence of construct validity of the instrument by showing that items measuring the same factor were highly correlated.

The correlation coefficients among the primary factors of causal attribution as produced by the factor analysis technique and the coefficients among the subtests are shown in Table 9. The upper triangle contains the correlation coefficients among the primary factors while the lower triangle contains the correlation coefficients among the subtests of the Causal Attribution Scale. The direct contributions of the factors are in the diagonal of the matrix (Table 9). The joint contributions were relatively low except the one between FACT1- Instructional Strategies and FACT6- Home Environment. Table 9 also indicates that the factors of causal attribution are essentially orthogonal although a small correlation appears between the factors of Instructional Strategy and Home Environment. Since an orthogonal solution is a special case of an oblique solution, and because of the correlation between the first and the sixth factors, the oblique solution was retained. The correlations among the subtests scores of causal attribution are generally low except for Home Environment with Instructional Strategy and Personal Organization. This suggests that the subtests scores of Home Environment are not as unitary as the other subtests scores.

Table 9

Factor Contributions and Correlation Coefficients Among the Primary Factors and the Subscales of the Causal Attribution Scale

	FACT1	FACT2	FACT3	FACT4	FACT5	FACT6
FACT1	3.377*	.000	.000	.019	.092	.396
FACT2	.367	1.806*	.002	-.008	-.002	-.001
FACT3	.567	.251	1.742*	.000	.000	.023
FACT4	.049	-.109	.148	1.817*	.004	.026
FACT5	.392	.155	.314	.026	1.885*	.074
FACT6	.702	.392	.784	.092	.399	2.906*

* direct variance contribution of factors

Item Analysis of the Causal Attribution Subscales

The six subscales were analyzed for internal consistency using LERTAP program written for the Laboratory of Educational Research of the University of Colorado and available in the Center for Research in Applied Measurement and Evaluation (CRAME) at the University of Alberta. This program gave a summary of the item statistics such as mean, standard deviation, correlation coefficient with the subscale, full scale and two external criteria of Gender and Region (urban/rural). It also gave the internal consistency for each subscale and the whole scale. These results are reported in Table 10.

Table 10

Internal Consistencies of the Six Subscales and the Whole Scale of Causal Attribution

Subscale	Items	Mean	Sd.	Se	I.C
Instructional Strategy	6	14.32	5.94	2.33	.82
Ability	4	10.59	3.24	1.82	.58
Personal Organization	3	7.70	3.41	1.84	.67
Effort	4	15.22	3.27	1.81	.59
State of Health	4	9.75	3.73	1.84	.67
Home Environment	5	11.64	4.98	2.14	.77
Whole Scale	26	72.51	16.55	6.19	.86

Sd- standard deviation

Se- standard error

I.C- internal consistency

Given the small number of items in the subscales an attempt was made to compute the possible reliability estimates if the subscales were lengthened to 10 items using the Spearman's Brown Prophecy formula given by the expression:

$$r_{xx} = (kp_{ii})/[1+ (k-1)p_{ii}]$$

where,

r_{xx} is the reliability of the lengthened scale

p_{ii} is the reliability of the shorter scale

k is the ratio of the number of items in the longer scale to the number of items in the shorter scale.

Substituting the internal consistency for Effort attribution (0.58), this extrapolation gave: $r_{xx}=(10/4*0.58)/[1+(1.5*0.58)]=0.775$, which is sufficiently high for most practical purposes.

The whole causal attribution scale for mathematics showed acceptable value for internal consistency Cronbach's alpha of 0.74 and Hoyt's Anova estimate of 0.86. Hoyt's Anova estimate was higher than Cronbach's alpha since the former was based on the analysis of variance treating persons and items as sources of variation while the later was based upon the sum of the subscale scores. Test length and different aggregation of items accounted for the difference. Cronbach's alpha is considered as the lower bound to a theoretical reliability coefficient, known as the coefficient of precision. Thus, its value is always less compared to other reliability estimates.

Item bias with respect to Gender and Region was tested by setting these two variables as the external criteria in the analysis. All the items had correlation coefficients with the external criteria that were not significantly different from zero.

Thus, there were no gender or Region (urban/rural) bias in the responses obtained from the study sample.

Differences Among the Six Causal Attribution Factors by Gender, Region and Perceived Performance.

In order to establish whether there were differences in the means of the subscales measuring each causal attribution factor with respect to Gender, Region and Perceived Performance (PERPER), a series of Three-way ANOVA tests were done. The means and standard deviations of the six causal attribution factors are summarized in Table 11.

Instructional strategy was rated as most important for perceived success by rural males and urban females, while effort attribution was rated least for perceived success by all students. The male students did not consider ability as important in making attribution for perceived success, but they considered it important for explaining perceived failure. The rural male students considered home environment as of least importance in making attribution for perceived failure, while urban males considered effort in making similar attributions. Female students attributed their perceived failure most to lack of ability and least to instructional strategy. These differences were further investigated using a Three-Way Analysis of Variance procedure. The results are discussed in the following section.

Table 11

Means and Standard deviations for the Causal Attribution Factors by Gender Perceived Performance.and Region

	Male				Female			
	Success		Failure		Success		Failure	
Variable	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
N	31	32	39	103	3	4	71	58
Instructional Strategy								
Mean	68.71	76.35	43.59	43.14	81.11	67.50	37.09	43.51
Std	14.47	20.90	15.90	18.69	15.40	14.24	14.71	16.14
Ability								
Mean	59.19	56.88	54.74	50.68	45.00	51.25	51.86	52.41
Std	15.55	15.85	16.10	16.42	15.00	16.01	17.14	15.48
Personal Organization								
Mean	72.90	73.13	50.26	45.92	70.00	63.75	46.62	46.98
Std	13.95	14.35	13.47	13.73	13.23	13.15	14.78	12.53
Effort								
Mean	48.06	46.09	39.74	43.54	56.67	51.25	38.38	44.74
Std	17.54	16.00	15.47	13.53	5.77	16.52	14.04	14.58
State of Health								
Mean	71.40	64.79	47.52	47.57	66.67	55.00	43.85	48.85
Std	16.62	18.10	17.11	17.49	26.67	16.67	17.30	18.62
Home Environment								
Mean	71.40	70.36	44.98	37.42	78.10	65.00	40.36	41.92
Std	16.24	17.56	18.31	13.49	3.30	6.75	14.54	14.43

FACT1 to FACT6 represent the six causal attribution factors as labelled in Table 8

As is shown in Table 12 to Table 17, there were no significant differences on the basis of gender and region in the mean ratings students assigned to the six causal attribution factors of: Instructional Strategy, Ability, Personal Organization, Effort, State of Health and Home Environment. However, significant differences existed between those students who perceived their performance as successful and those who perceived it as failure in all the six factors except in the causal attribution factor of ability. None of the interactions was significant for all the six factors.

Table 12

Three-Way ANOVA Results for Instructional Strategy by Gender, PERPER and Region

Source of Variation	Df	Mean Square	F	p
Gender	1	9.366	.032	.857
PERPER	1	22373.662	77.484	<.001
Region	1	.000	0.000	.999
Gender x PERPER	1	131.396	.455	.500
Gender x Region	1	290.012	1.004	.317
PERPER x Region	1	199.387	.690	.407
3-Way Interaction	1	1108.223	3.838	.051
Residual	333	288.766		

Table 13

Three-Way ANOVA Results for Ability by Gender, PERPER and Region

Source of Variation	Df	Mean Square	F	p
Gender	1	616.230	2.336	.127
PERPER	1	9.638	.037	.849
Region	1	.250	.001	.975
Gender x PERPER	1	488.433	1.852	.175
Gender x Region	1	243.724	.924	.337
PERPER x Region	1	77.595	.294	.588
3-Way Interaction	1	21.866	.083	.774
Residual	333	263.789		

Table 14

Three-Way ANOVA Results for Personal Organization by Gender, PERPER and Region.

Source of Variation	Df	Mean Square	F	p
Gender	1	309.251	1.623	.204
PERPER	1	11351.462	59.561	<.001
Region	1	140.130	.735	.392
Gender x PERPER	1	131.921	.692	.406
Gender x Region	1	4.414	.023	.879
PERPER x Region	1	5.931	.031	.860
3-Way Interaction	1	174.830	.917	.339
Residual	333	190.587		

Table 15

Three-Way ANOVA Results for Effort by Gender, PERPER and Region

Source of Variation	Df	Mean Square	F	p
Gender	1	258.948	1.202	.274
PERPER	1	1782.807	8.275	.004
Region	1	10.783	.050	.823
Gender x PERPER	1	271.722	1.261	.262
Gender x Region	1	1.097	.005	.943
PERPER x Region	1	431.601	2.003	.158
3-Way Interaction	1	50.570	.235	.628
Residual	333	215.450		

Table 16

Three-Way ANOVA Results for State of Health by Gender, PERPER and Region

Source of Variation	Df	Mean Square	F	p
Gender	1	401.153	1.288	.257
PERPER	1	6879.080	22.081	<.001
Region	1	245.089	.787	.376
Gender x PERPER	1	206.368	.662	.416
Gender x Region	1	.018	.000	.994
PERPER x Region	1	762.775	2.448	.119
3-Way Interaction	1	140.468	.451	.502
Residual	333	311.536		

Table 17

Three-Way ANOVA Results for Home Environment by Gender, PERPER and Region

Source of Variation	Df	Mean Square	F	p
Gender	1	2.101	.009	.923
PERPER	1	20237.583	89.142	<.001
Region	1	568.378	2.504	.115
Gender x PERPER	1	2.994	.013	.909
Gender x Region	1	12.092	.053	.818
PERPER x Region	1	92.747	.409	.523
3-Way Interaction	1	628.480	2.768	.097
Residual	333	227.025		

Having examined the existence of differences in the mean ratings of the causal attribution factors among students on the basis of Gender, Region and Perceived Performance it was considered necessary to investigate the possible sources of these differences by considering both student and school characteristics in a Hierarchical Linear Model (HLM) explained in Chapter 3. The results of the HLM analyses are presented in the following sections.

Hierarchical Linear Modeling (HLM) Analyses

The HLM analyses were done to investigate the sources of variance in the ratings of the six factors of causal attribution by using selected student-level and school-level variables. The student-level variables considered in addition to the six causal attribution factors were Gender coded Male (1), Female (2), Mathematics Scores rated on a 4-point scale and Perceived Performance coded Success (1) and Failure (2). The school-level variables included in the model were Region coded Urban (1) and Rural (2), and Mean Social Economic Status (MNSES) rated on a 4-point scale.

The distribution of the student variables, their means and standard deviations are shown in Table 1 and Table 2. The descriptive statistics of Mathematics Score, Socio-economic status and the six causal attribution factors distributed by school are summarized in Table 18.

Table 18

Means and Standard Deviations of Variables by School

		Schools									
		A	B	C	D	E	F	G	H	I	J
VAR	Size	34	36	32	32	34	32	35	32	37	37
MAT	M	1.79	1.33	1.13	1.25	1.26	1.28	1.03	1.00	1.84	1.51
	Sd	.98	.63	.34	.62	.45	.46	.17	.00	1.09	.84
SES	M	2.82	2.83	1.47	1.81	1.47	1.63	1.06	1.06	2.65	2.65
	Sd	1.19	1.06	.62	1.00	.66	.75	.24	.25	.21	.89
F1	M	50.5	42.1	40.3	42.9	53.1	57.7	51.1	49.3	48.3	45.6
	Sd	20.5	15.1	15.6	17.9	28.7	28.9	16.7	13.6	20.0	22.3
F2	M	54.3	50.5	50.5	52.2	51.9	51.1	55.9	51.4	56.2	55.3
	Sd	17.2	15.3	17.9	15.7	15.6	15.5	16.3	14.5	14.9	18.3
F3	M	55.4	49.3	50.8	46.6	59.9	59.2	43.7	46.1	56.5	53.8
	Sd	17.6	14.7	13.5	15.4	19.7	20.1	10.3	10.7	19.7	17.1
F4	M	46.6	36.1	47.7	45.6	46.0	47.5	40.4	39.8	43.0	39.5
	Sd	18.9	9.7	13.7	14.9	14.5	14.2	13.9	11.8	16.4	14.2
F5	M	55.1	48.0	48.1	50.4	58.4	55.0	44.8	48.8	50.5	51.7
	Sd	21.6	18.8	17.5	16.3	22.2	18.0	16.0	18.6	19.2	21.1
F6	M	51.5	44.0	42.3	40.4	51.9	54.2	39.2	40.0	53.1	47.8
	Sd	20.5	16.8	15.5	17.6	23.3	22.0	10.7	13.7	21.3	21.2

F1 to F6 are the six causal attribution factors; M - Mean; Std - Standard deviation; VAR - Variable; A, B, I, & J are Urban schools; C to H are rural schools

The correlation coefficients among the student-level variables selected for the HLM analyses are presented in Table 19. Gender had weak and negative relationships with all the causal attribution factors. Perceived Performance had moderately strong and negative relationships with Instructional Strategy, Personal Organization, State of Health, and Home Environment. However, it had weak relationship with Ability and Effort. The correlation coefficients among the factors were generally low except those related to Instructional Strategy and between Personal Organization and Home Environment. Given that these correlations were obtained directly using item scores, the low values were expected based on the correlation among the factors provided by the factor analysis procedure.

The literature review presented in Chapter 2 indicated that most of the studies on causal attribution to academic performance were based on the actual performance scores. However, in the present study the ratings of the causal attribution factors were based on the student's perceived performance (success/failure). The square of the correlation values as presented in Table 19, between perceived performance and each of the six causal attribution factors were computed. These values represented the proportion of variance in each of the six causal attribution factors that was predictable by perceived performance in mathematics. Squared multiple correlation values were also obtained for the six causal attribution factors using perceived performance and mathematics scores as the predictor variables.

Table 19

Correlation Coefficients Among the Student- and School-Level Variables

	1	2	3	4	5	6	7	8	9	10	11
1	1.000										
2	-.211	1.000									
3	.310	-.486	1.000								
4	-.245	.323	-.591	1.000							
5	-.054	.072	-.127	.367	1.000						
6	-.208	.337	-.598	.567	.251	1.000					
7	-.067	.124	-.158	.049	-.109	.148	1.000				
8	-.177	.375	-.423	.392	.155	.314	.026	1.000			
9	-.164	.378	-.633	.702	.392	.784	.092	.399	1.000		
10	.719	.105	.360	-.588	.022	-.396	-.347	-.070	-.310	1.000	
11	.790	.291	.597	-.708	-.137	-.535	-.335	-.219	-.506	.938	1.000

1. Gender, 2. Mathematics Score, 3. Perceived Performance, 4. Instruction Strategy, 5. Ability, 6. Personal Organization, 7. Effort, 8. State of Health, 9. Home Environment, 10. Region, 11. Mean SES.

As reported in Table 20, no significant increase in the proportion of variance in the six causal attribution factors was noted with mathematics scores included as a predictor variable. These findings showed that there was no unique information added by mathematics scores in the prediction of the ratings of each of the six causal attribution factors when used together with perceived performance as predictor variables. Thus the interpretation of the findings should be similar to those studies done using the actual performance scores. These findings do not concur with what has been found in the Western societies, in that, both the students and parents in these societies seem to be satisfied with low performance and even perceive it as success which would be perceived as failure in Asian and African societies. This could be attributed to the cultural differences that exist among these societies.

Table 20

Proportion of Variance accounted for by the Causal Attribution Factors as Dependent Variables and Mathematics Scores and Perceived Performance as Predictors

	Dependent Variables					
Predictor Variables	FACT1	FACT2	FACT3	FACT4	FACT5	FACT6
PERPER	.350	.016	.358	.025	.179	.401
PERPER &MATSC	.350	.016	.360	.028	.217	.407

The relationships and variations among the causal attribution factors with respect to the student- and school-level variables were further investigated using a series of Hierarchical Linear Models. Although the focus of the study was not on performance in mathematics per se, it was considered necessary to investigate the relationship between mathematics scores and the other variables first. This was followed by the analysis of the six causal attribution factors with respect to Gender, Region and Perceived Performance.

The outcome variable for the following analyses is the mathematics scores (coded MATSC). The analysis began by fitting a One-Way Random-Effect

ANOVA model in order to determine how much variability in the outcome variable (MATSC) was within and between schools and about the reliability of each school's sample mean as an estimate of its true population mean. This model is represented by the following equations:

Student-Level: $(MATSC)_{ij} = \beta_{0j} + \varepsilon_{ij}$,

School-Level: $\beta_{0j} = \gamma_{00} + u_{0j}$,

where,

i is the i^{th} student,

j is the j^{th} school or unit,

β_{0j} is constant to be found for each of j units,

ε_{ij} is the Student-Level error component, $\varepsilon_{ij} \sim N(0,\sigma^2)$,

γ_{00} is the mean outcome for unit j,

u_{0j} is the School-level error component , $u_{0j} \sim N(0,\tau_{00})$.

The results are provided in Table 21.

The maximum likelihood estimate for the average school mean in mathematics performance, γ_{00} is 1.382. This confirms earlier results which showed that on average, mathematics was a poorly performed subject in the schools in the study sample. The maximum likelihood estimate of the pooled within-school variance component, var (ε_{ij}), is 0.4795 while the estimated variability in true school means, τ_{00}, is 0.0652. Although these estimates were generally low, most of the variation in mathematics performance was at the student level.

Table 21

HLM Results of One-Way Random Effect ANOVA Model With Mathematics Scores as the Dependent Variable

Fixed Effect	Coefficient	Se	Df	t	p
Intercept, γ_{00}	1.382	.0938	7	14.731	<.001
Random Effect	**Variance**	**Df**	**χ^2**	**p**	
School Mean, u_{0j}	.0652	8	45.928	<.001	
Student-Level, ε_{ij}	.4795				
Reliability	.8289				

The intraclass correlation is given by the expression:

$$\rho = \tau_{00}/(\tau_{00} + \sigma^2).$$

This gives a value of 0.119, indicating that 11.9% of the variance in mathematics performance was between schools when not controlling for any covariate. Conversely, 88.1% of the variance in mathematics scores is potentially explainable by within school factors. The reliability estimates vary from school to school because of the unequal sample sizes. The overall reliability estimate is the average of all the school reliabilities. This was given as, 0.829, indicating that the sample means were highly reliable estimates of the true school means in mathematics scores.

To test the hypothesis that all schools have the same mean score, that is, H0: $\tau_{00}=0$, the Chi-square statistic with (J-1) degrees of freedom, where J is the number of schools used. One school was dropped because of a zero variance in mathematics scores. The null hypothesis was rejected ($\chi^2=45.928$, df=8, $p \leq .001$).

Thus, there exists significant variations in mathematics performance among schools.

To investigate the contribution of Region, a school-level variable, to the variability of mathematics scores the One-Way Random Effect ANOVA model was modified by incorporating REGION, at the school-level. The new model is referred to as Means-as-Outcomes model and is represented by the following equations:

Student-Level $(\mathrm{MATSC})_{ij} = \beta_{0j} + \varepsilon_{ij}$

School-Level $\beta_{0j} = \gamma_{00} + \gamma_{01}(\mathrm{REGION})_j + u_{0j}$.

where, γ_{01} is the unit level regression coefficient associated with REGION. The rest of the symbols remain as defined before.

As shown in Table 22 there was a significant association between Region and mean mathematics performance ($\gamma_{01}=-0.430$, Se=0.120, t=-3.574, $p \leq .05$). On average, Region has a negative relationship with mathematics scores within schools. This result implied that urban schools' students did relatively better than rural schools' students in mathematics. The variance explained by Region is given by:

$$\text{Variance explained}=\frac{\tau_{00}(\text{Unconditional Model})-\tau_{00}(\text{Conditional Model})}{\tau_{00}(\text{Unconditional Model})}$$

This gave a value of 0.7193, meaning that about 71.9% of the true between school variance in mathematics scores was accounted for by REGION. The Chi-square statistic that tests the hypothesis that the residual differences among schools' means were essentially zero was rejected ($\chi^2=16.234$, df=7, $p \leq .05$), implying that REGION did not account for all the significant school means' variance. Other variables not included in the model could be accounting for some of the remaining variance.

Table 22

HLM Results of Mathematics Score as Outcome and REGION as School-Level Predictor

Fixed Effect	Gamma	Se	Df	t	p
Intercept, γ_{00}	2.0489	.1954	6	10.485	<.001
REGION, γ_{10}	-0.4299	.1203	6	-3.574	.0117
Random Effect	Variance	Df	χ^2	p	
School Mean, u0j	.0183	7	16.234	.023	
Student-Level, ε_{ij}	.4794				
Reliability Estimate	.5845				

After removing the effect of Region, the intraclass correlation given by $\rho = \tau_{00}/(\tau_{00} + \sigma^2)$, was 0.0368, implying that only about 3.7% of the variance in mathematics scores was between schools. This value was a conditional intraclass correlation and measures the degree of dependence among observations within schools that were from the same REGION. The conditional reliability, that is, the reliability with which one can discriminate among schools that were from the same region was 0.5845. As expected the reliability of the residuals was less than that of the sample means.

To investigate how the student-level variable of Gender influences mathematics performance, the following model was used:

Student-Level $(MATSC)_{ij} = \beta_{0j} + \beta_{1j}(GENDER)_{ij} + \varepsilon_{ij}$

School-Level: $\beta_{0j} = \gamma_{00} + u_{0j}$,

$\beta_{1j} = \gamma_{10} + u_{1j}$,

where,

β_{0j}, β_{1j} are Student-Level coefficients,

γ_{00}, γ_{10} are School-Level coefficients,

ε_{ij}- is student-level error component, $\varepsilon_{ij} \sim N(0,\sigma^2)$, $Var(\varepsilon_{ij})=\sigma^2$

u_{0j}, u_{1j} are School-Level error components,

$u_{0j} \sim N(0, \tau_{00})$, $Var(u_{0j}) = \tau_{00}$,

$u_{1j} \sim N(0, \tau_{11})$, $Var(u_{1j}) = \tau_{11}$

In the Hierarchical Linear Modeling (HLM) procedure, the model is referred to as the Random-Coefficient model. The results obtained using the model appear in Table 23. Interest in this investigation was in finding the average intercepts and slopes across schools and the strength of the relationship between the intercepts and slopes. The results indicated that Gender was significantly related to mathematics performance (γ_{10}= -.437, t= -2.439, $p \leq .05$). The negative value of γ_{10} implies that male students were more likely to do better in mathematics than female students. As found in previous results, there existed significant differences among the school mean mathematics performance, (τ_{00}= .0717, df=8, χ^2 =59.162, $p \leq .001$). The estimated variance of the slopes, τ_{11} was .242. The null hypothesis H0: $\tau_{11}=0$, was rejected (χ^2=47.648, $p \leq .001$). Thus, the relationship between Gender and mathematics scores varied significantly among schools.

Table 23

HLM Results of Mathematics Scores as Outcome and Gender as Student-Level Predictor

Fixed Effect	Gamma	Se	Df	t	p
Intercept, γ_{00}	1.382	.0958	7	14.436	<.001
Gender Slope, γ_{10}	-.4372	.1793	7	-2.439	.045
Random Effect	Variance	Df	$\chi 2$	p	
Intercept, u_{0j}	.0717	8	59.162	<.001	
Gender Slope, u_{1j}	.2415	8	47.6475	<.001	
Student-level, ε_{ij}	.372				
Reliability Estimate					
Intercept	0.911				
Gender Slope	0.914				

The overall reliability of the school means was 0.991, while that of the Gender slopes was 0.914, indicating that the slopes were reliable measures of the relationships between mathematics and Gender across schools. The student variance this time was $\sigma^2 = 0.372$ which was less than the One-Way Random ANOVA Model value of 0.4795. As would be expected, adding Gender as a predictor of mathematics performance at the student-level reduced the within school variance. The proportion of variance accounted for by this additional variable was obtained as follows:

$$\text{Proportion of variance} = \frac{[\sigma^2(\text{ANOVA Model}) - \sigma^2(\text{Model with Gender})]}{\sigma^2(\text{ANOVA Model})}$$

Substituting the value in the expression gave, (0.4795-0.3720)/0.4795=0.2240. Thus Gender accounted for about 22.4% of the student-level variance in mean mathematics scores.

The correlation between the intercepts and the slopes was obtained by using the following expression;

$$\rho(\beta_{0j},\beta_{1j}) = \tau_{01}/(\tau_{00}\ \tau_{11})^{1/2}, \text{ which gave}$$

$$-0.1308/(0.0717 \times 0.2415)^{1/2}=-0.994.$$ This implied that there was a very strong negative relationship between school means in mathematics scores and Gender effects, that is, there were strong Gender effects in schools with low mean mathematics scores.

To investigate whether urban schools differ from their rural counterparts in terms of the strength of association between Gender and the mean mathematics performance, the following model was used:

Student-Level $(MATSC)_{ij} = \beta_{0j}+ \beta_{1j}(GENDER) + \varepsilon_{ij}$

School-Level: $\beta_{0j} =\gamma_{00} + \gamma_{01}(REGION) + u_{0j},$

$\beta_{1j} = \gamma_{10}+ \gamma_{11}(REGION) + u_{1j},$

The results of this model are summarized in Table 24.

It was evident that urban schools had significantly higher mean mathematics scores than rural schools (γ_{01}= -0.431, t=-3.337, Se=0.129, $p \leq .05$). However, there were no significant Gender effect differences between urban and rural schools (γ_{11}= .630, t=2.107, Se=.299 $p > .05$).

The variation in mean mathematics scores explained by REGION was given by:

$$\frac{\tau_{00}(\text{Unconditional Model}) - \tau_{00}(\text{Conditional Model})}{\tau_{00}(\text{Unconditional Model})} = \frac{.072-.026}{.072}$$

$$= .6389$$

Table 24

HLM Results of Mathematics as Outcome Variable, Gender as Student-Level Predictor and Region as School-Level Predictor

Fixed Effect	Gamma	Se	Df	t	p
School Mean					
Intercept, γ_{00}	2.051	0.210	6	9.758	<.0001
Region, γ_{01}	-0.431	0.129	6	-3.337	.016
Gender Slope					
Intercept, γ_{10}	-1.420	0.485	6	-2.930	0.026
Region, γ_{11}	0.630	0.299	6	2.107	0.080
Random Effect	**Variance**	**Df**	**χ^2**	**p**	
Intercept, u_{0j}	0.026	7	21.013	0.004	
Slope, u_{1j}	0.152	7	28.623	0.001	
Student-Level,	0.370				
Reliability Estimate.					
Intercept	0.8425				
Gender Slope	0.8750				

Thus, about 64% of the variance in mean mathematics scores was explained by REGION. Significant residual variance between schools remain unexplained (χ^2=21.013, df=7, p ≤.05). Other school-level variables might be used to explain the remaining variance in school means in mathematics. A test of the hypothesis that residual variance of the true slopes was zero, that is H_0: $\tau_{11}=0$ was rejected ($\chi^2=28.623$, df=7, $p \leq .01$). This indicated that significant variance in Gender effect remain unexplained even when Region was used as a predictor at the school-level.

HLM Results of the Causal Attribution Factors as the Outcome Variables.

The following equations were used in the One-Way ANOVA model analysis with each of the six causal attribution factors as the dependent variable.

Student-level: $Y_{ij} = \beta_{0j} + \varepsilon_{ij}$, where $\varepsilon_{ij} \sim N(0,\sigma^2)$

School-level: $\beta_{0j} = \gamma_{00} + u_{0j}$ where $u_{0j} \sim N(0\ \tau_{00})$

where,

Y_{ij}- Students' ratings on the causal attribution factors.

The results of the model when each of the six causal attribution factors was used as the outcome variable are reported in Table 25.

Table 25

Partitioning of Variance of the Causal Attribution Factors into Within and Between Schools

a) Instruction Strategy

Fixed Effect	Coefficient	Se	Df	t	p
School Mean, γ_{00}	48.0745	1.6848	8	28.5341	<.001
Random Effect	Variance	Df	χ_2	p	
School Mean, u_{0j}	15.5491	9	19.8589	.019	
Student-level, ε_{ij}	436.9253				
Reliability Estimate	.5322				

b) Ability

Fixed Effect	Coefficient	Se	Df	t	p
School mean, γ_{00}	52.9901	.9243	8	57.3316	<.001
Random Effect	Variance	Df	χ_2	p	
School Mean, u_{0j}	.6970	9	6.0258	.7370	
Student-level, ε_{ij}	266.7763				
Reliability Estimate	.1364				

c) Personal Organization

Fixed Effect	Coefficient	Se	Df	t	p
School mean, γ_{00}	52.1355	1.7922	8	29.0907	<.001
Random Effect	Variance	Df	χ_2	p	
School Mean, u_{0j}	24.0603	9	35.7302	<.001	
Student-level, ε_{ij}	274.1119				
Reliability Estimate	.7451				

Table 25 continued

d) Effort

Fixed Effect	Coefficient	Se	Df	t	p
School mean, γ_{00}	43.1748	1.2813	8	33.6952	<.001
Random Effect	Variance	Df	χ^2	p	
School Mean, u_{0j}	10.1165	9	23.5069	.0050	
Student-level, ε_{ij}	214.4481				
Reliability Estimate	.6187				

e) State of Health

Fixed Effect	Coefficient	Se	Df	t	p
School mean, γ_{00}	51.0550	1.2925	8	39.5004	<.001
Random Effect	Variance	Df	χ^2	p	
School Mean, u_{0j}	5.6751	9	13.6319	.1360	
Student-level, ε_{ij}	375.7149				
Reliability Estimate	.3392				

f) Home Environment

Fixed Effect	Coefficient	Se	Df	t	p
School mean, γ_{00}	46.4632	1.8000	8	24.8679	<.001
Random Effect	Variance	Df	χ^2	p	
School Mean, u_{0j}	24.2899	9	29.4911	.0010	
Student-level, ε_{ij}	361.2789				
Reliability Estimate	.6906				

The means ranged from 43.1748 for Effort attribution to 52.9901 for the Ability attribution factor. The standard error was largest for the Home Environment attribution (Se=1.8684) and least for the Ability attribution factor (Se=.9243). The maximum likelihood estimate of the student-level variance component, $\mathrm{Var}(\varepsilon_{ij})$, ranged from 214.4481 for Effort attribution to 436.9253 for Instructional Strategy attribution, while the estimated variability in true school mean var(u_{0j}) ranged from .6970 for Ability to 24.2899 for Home Environment attribution. Thus most of the variation in the students' ratings of the six attribution factors was at the student level.

Intraclass correlation = var(u_{0j})/ var($u_{0j}+\sigma^2$) were as follows: Instructional Strategy .0343 (3.43%); Ability .00261 (.261%); Personal Organization .0807 (8.07%); Effort .0450 (4.50%); State of Health .0149 (1.49%) and Home Environment .0630 (6.3%). The intraclass correlation values provide the amount of variance in each of the six factors that is between schools. It is evident that the proportion of variance between schools is small, however the Chi-square values indicate that significant variance existed between schools in the ratings of Instructional Strategy (χ^2=19.8589, df=9, $p \leq .05$), Personal Organization (χ^2=35.7302, df=9, $p \leq .001$), Effort (χ^2=23.5069, df=9, $p \leq .01$), and Home Environment attributions (χ^2=29.4911, df=9, $p \leq .01$). Non-significant variance between school means was obtained for Ability and State of Health attribution. The reliability estimates varied from school to school because of the unequal sample sizes. The overall reliability estimate for each of the factors was the average of all the school reliabilities. These estimates are shown in Table 25. It is evident that only the sample means of Instructional Strategy, Personal Organization, Effort, and Home Environment causal attribution were reliable indicators of the true school means.

Causal Attribution Factors with Region as School Level Variable.

For this model the student-level equation remained as in the previous model, but the school level model had the mean as the dependent variable and school characteristic of REGION as the independent variable. The model is referred to as means-as-outcomes (Bryk, & Raudenbush, 1992), and is represented by the following equations:

Student-level: $Y_{ij} = \beta_{0j} + \varepsilon_{ij}$

School-level: $\beta_{0j} = \gamma_{00}+\gamma_{01}(\text{REGION})+u_{0j}$

The symbols are as defined in the previous models.

Only the causal attribution factors that had significant mean differences across schools were considered in this model. These factors were Instructional Strategy, Personal Organization, Effort and Home Environment. The HLM results are provided in Table 26. The averages of the Region slope estimates indicated that Personal Organization and Home Environment were negatively related to Region, while Instructional Strategy and Effort were positively related to Region. The results showed that urban schools had higher mean ratings in Personal Organization and Home Environment than did rural schools. However, rural schools had higher mean ratings in Instructional Strategy and Effort than urban schools. The intraclass correlations for mean ratings of the four causal attribution factors considered in this model changed slightly.

Table 26

Causal Attribution Factors as Outcome Variable and Region as School-Level Predictor

a) Instruction Strategy

Fixed Effect	Coefficient	Se	Df	t	p
School Mean, γ_{00}	44.1085	5.8681	7	7.5167	<.001
Region, γ_{01}	2.4939	3.5247	7	.7076	.5021
Random Effect	Variance	Df	χ^2	p	
School Mean, u_{0j}	17.2027	8	18.6089	.017	
Student-level, ε_{ij}	436.9299				
Reliability Estimate	.5535				

b) Personal Organization

Fixed Effect	Coefficient	Se	Df	t	p
School Mean, γ_{00}	56.4734	6.2595	7	9.0220	<.001
Region, γ_{01}	-2.7205	3.7513	7	-0.7252	.4919
Random Effect	Variance	Df	χ^2	p	
School Mean, u_{0j}	25.8581	8	33.4594	<.001	
Student-level, ε_{ij}	274.1094				
Reliability Estimate	.7580				

c) Effort

Fixed Effect	Coefficient	Se	Df	t	p
School Mean, γ_{00}	38.0241	4.1865	7	9.0825	<.001
Region, γ_{01}	3.2353	2.5142	7	1.2868	.2391
Random Effect	Variance	Df	χ^2	p	
School Mean, u_{0j}	8.9796	8	19.3958	.013	
Student-level, ε_{ij}	214.4569				
Reliability Estimate	.5878				

Table 26 continued,

d) Home Environment

Fixed Effect	Coefficient	Se	Df	t	p
School Mean, γ_{00}	53.5164	6.1959	7	8.6373	<.001
Region, γ_{01}	-4.4269	3.7168	7	-1.1911	.2724
Random Effect	**Variance**	**Df**	**χ^2**	**p**	
School Mean, u_{0j}	22.7229	8	24.9792	.0020	
Student-level, ε_{ij}	361.2835				
Reliability Estimate	.6746				

The proportion of between schools' variance in mean ratings in each of the four factors explained by Region is as given before:

$$\text{Proportion of variance} = \frac{[\tau_{00}(\text{ANOVA Model}) - \tau_{00}(\text{Model with Region})]}{\tau_{00}(\text{ANOVA Model})}$$

Region accounted for about 11.24% and 6.45% of the true between school variance in Effort and Home Environment attribution factors respectively. However, Instructional Strategy and Personal Organization gave a negative difference between the two models. Instead of the school mean variance decreasing when Region was added to the school-level equation, it increased for these two factors. Thus, the results for the two causal attribution factors could not be meaningfully interpreted.

The Chi-square values indicate that the residual differences among schools in mean ratings was not essentially zero for all the four factors. This means that there remained significant unexplained between school variance in Instructional Strategy, Personal Organization, Effort, and Home Environment even when Region was controlled for.

The analysis was repeated with Mean Socio-Economic Status (MNSES) included as an additional school-level variable. The between school variance that was accounted for by Region and MNSES increased for Effort attribution to 40.7% but decreased to 2.5% for Home Environment. This result implied that there existed an interaction between region and MNSES especially for the Home Environment attribution factor. None of the school mean variances associated with the four factors was significant at $p \leq .05$. There was no significant unexplained between school variance remaining in Effort, but Instructional Strategy, Personal Organization and Home Environment still retained significant unexplained between school variance. The results of the model that included MNSES at the school-level are presented in Table 27.

The intraclass correlations for mean ratings in Instructional Strategy, Personal Organization, Effort and Home Environment attributions were .0379, .0862, .0402 and .0592 respectively. With MNSES included as a school-level variable there was no significant change in the intraclass correlations. These estimates are conditional values and measure the degree of dependence among observations within schools that were from the same Region. The reliability estimates were also conditional values and measured the reliability with which one could discriminate among schools that belonged to the same Region. As would be expected the reliability estimates of the residuals were less than those of the sample means. This assertion did not hold true for Instructional Strategy and Personal Organization because they had values that were greater than those of the sample means. No significant changes occurred in the reliability values when MNSES was added to the school-level equation.

Table 27

Causal Attribution Factors as Outcome Variable and Region and MNSES as School-Level Predictors

a) Instruction Strategy

Fixed Effect	Coefficient	Se	Df	t	p
School Mean, γ_{00}	40.5372	9.9847	6	4.0599	.0067
Region, γ_{01}	-2.5502	11.6380	6	-.2191	.8338
MNSES	3.8074	8.3327	6	.4569	.6638

Random Effect	Variance	Df	χ^2	p
School Mean, u_{0j}	20.5617	7	18.0650	.011
Student-level, ε_{ij}	436.9117			
Reliability Estimate	.5955			

b) Personal Organization

Fixed Effect	Coefficient	Se	Df	t	p
School Mean, γ_{00}	64.6505	9.9978	6	6.4665	<.001
Region, γ_{01}	8.7900	11.6310	6	.7557	.4784
MNSES	-8.6996	8.3268	6	-1.0448	.3364

Random Effect	Variance	Df	χ^2	p
School Mean, u_{0j}	25.4448	7	28.9335	<.0001
Student-level, ε_{ij}	274.1152			
Reliability Estimate	.7537			

c) Effort

Fixed Effect	Coefficient	Se	Df	t	p
School Mean, γ_{00}	46.4556	5.9969	6	7.7466	<.001
Region, γ_{01}	15.1301	7.0027	6	2.1606	.0740
MNSES	-8.9829	5.0144	6	-1.7914	.1234

Random Effect	Variance	Df	χ^2	p
School Mean, u_{0j}	5.7444	7	13.3912	.063
Student-level, ε_{ij}	214.4169			
Reliability Estimate	.4866			

Table 27 continued,

d) Home Environment

Fixed Effect	Coefficient	Se	Df	t	p
School Mean, γ_{00}	60.4890	10.1185	6	5.9780	<.001
Region, γ_{01}	5.3892	11.7823	6	.4574	.6635
MNSES	-7.4180	8.4355	6	-.8794	.4130
Random Effect	**Variance**	**Df**	**χ^2**	**p**	
School Mean, u_{0j}	23.6914	7	22.5258	.0020	
Student-level, ε_{ij}	361.2847				
Reliability Estimate	.6833				

To investigate the relationship between Gender and the four attribution factors, the following model was used:

Student-level: $Y_{ij} = \beta_{0j}+\beta_{1j}(\text{Gender}) + \varepsilon_{ij}$

School-level: $\beta_{0j} = \gamma_{00}+u_{0j}$

$\beta_{1j} = \gamma_{10}+u_{1j}$

where,

β_{0j} and β_{1j} are the gamma coefficients for school j,

γ_{00} is the average of the school means,

γ_{10} is the average of the Gender regression slopes,

ε_{ij}, is the student-level equation error term,

u_{0j} and u_{1j} are the unique increments to the school j intercept and Gender slope respectively.

The results reported in Table 28 indicate that on average Gender was significantly negatively related to Instructional Strategy, Personal Organization and Home Environment, but not significantly related to Effort.

Table 28

HLM Results of the Causal Attribution Factors with Gender as a Predictor at the Student-Level

a) Instructional Strategy

Fixed Effect	Coefficient	Se	Df	t	p
School mean, γ_{00}	48.0325	1.6903	8	28.4157	<.001
Gender Slope, γ_{01}	-10.3922	3.4076	8	-3.0497	.0158
Random Effect	Variance	Df	$\chi 2$	p	
School mean, u_{0j}	16.8346	9	21.7229	.010	
Gender Slope, u_{1j}	64.5968	9	20.1207	.017	
Student-level, ε_{ij}	399.4364				
Reliability Estimates:	School Means= .5762		Gender Slope= .5815		

b) Personal Organization.

Fixed Effect	Coefficient	Se	Df	t	p
School mean, γ_{00}	52.1765	.9412	8	55.4334	<.001
Gender Slope, γ_{01}	-7.9801	2.0177	8	-3.9551	.0042
Random Effect	Variance	Df	$\chi 2$	p	
School mean, u_{0j}	.5603	9	34.7636	<.001	
Gender Slope, u_{1j}	4.3325	9	15.7424	.072	
Student-level, ε_{ij}	281.7218				
Reliability Estimates:	School Means= .0174		Gender Slope= .0682		

c) Effort.

	Coefficient	Se	Df	t	p
School mean, γ_{00}	43.1764	1.2815	8	33.6931	<.001
Gender Slope, γ_{01}	-1.3722	2.3619	8	-.5810	.5773
Random Effect	Variance	Df	$\chi 2$	p	
School mean, u_{0j}	10.2956	9	24.1829	.0040	
Gender Slope, u_{1j}	28.8055	9	18.6160	.028	
Student-level, ε_{ij}	208.4570				
Reliability Estimates:	School Means= .6297		Gender Slope= .5074		

Table 28 continued,

d) Home Environment

Fixed Effect	Coefficient	Se	Df	t	p
School mean, γ_{00}	46.5263	1.0593	8	43.9230	<.001
Gender Slope γ_{01}	-7.6297	2.2257	8	-3.4280	.0090
Random Effect	Variance	Df	χ_2	p	
School mean, u_{0j}	.3225	9	28.6981	<.001	
Gender Slope, u_{1j}	1.8319	9	19.6617	.020	
Student-level, ε_{ij}	371.2180				
Reliability Estimates:	School Means= .0092	Gender Slope= .0178			

These results would imply that males had significantly higher mean ratings in the three factors but not in Effort.

Significant estimated variance still existed among school means in the four factors even with the additional predictor of Gender. The estimated variances of the Gender slopes across schools were significant for Instructional Strategy (χ^2=20.1207, df=9, $p \leq .05$), Effort (χ^2=18.6160, df=9, $p \leq .05$), and Home Environment χ^2=19.6617, df=9, $p \leq .05$). Significant variations, therefore, existed in Gender slopes across schools in these factors, but not in Personal Organization.

Comparing the current model with the previous One-Way ANOVA model, the additional predictor variable of Gender accounted for about 8.58% and 2.79% of the total variance in Instructional Strategy and Effort attributions respectively. The variance estimates for Personal Organization and Home Environment could not be meaningfully interpreted.

In order to investigate why some schools have higher means and stronger Gender association with the causal attribution factors a model incorporating a school-level variable of Region was used. Bryk and Raudenbush (1992) refer to this model as an Intercept-and-Slope-as-Outcomes model.

Student-level: $Y_{ij} = \beta_{0j} + \beta_{1j}(\text{Gender}) + \varepsilon_{ij}$

School-level: $\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Region}) + u_{0j}$.

$\beta_{1j} = \gamma_{10} + \gamma_{11}(\text{Region}) + u_{1j}$,

where,

γ_{01} and γ_{11} are the main effects of Region and the rest of the symbols are as defined before.

Specifically the model helped in investigating how much variation in the average school means and Gender slopes was explained by Region. As is shown in Tables 29, on average, rural schools had significantly higher gender slope estimates than urban schools in their mean ratings in Instructional Strategy, Personal Organization and Home Environment at the $p \leq .05$. However, no significant Region effect on the Gender slopes was found in the mean ratings of Effort.

Table 29

HLM Results of the Causal Attribution Factors by Gender and Region

a) Instructional Strategy.

Fixed Effect	Coefficient	Se	Df	t	p
School Mean					
Intercept, γ_{00}	44.0086	3.7539	7	11.7234	.0001
Region, γ_{01}	2.5642	2.2701	7	1.1295	.2959
Gender Slope					
Intercept, γ_{10}	-27.6994	7.6586	7	-3.6168	.0085
Region, γ_{11}	11.2660	4.7218	7	2.3860	.0485

Random Effect	Variance	Df	χ^2	p
Intercept, u_{0j}	.2303	8	19.3346	.013
Gender Slope, u_{1j}	1.3123	8	13.2810	.103
Student-level, ε_{ij}	420.5067			
Reliability Estimates	Intercept= .0074		Gender Slope= .0148	

b) Effort

Fixed Effect	Coefficient	Se	Df	t	p
School Mean					
Intercept, γ_{00}	38.0225	4.1823	7	9.0914	<.0001
Region, γ_{01}	3.2387	2.5113	7	1.2896	.2382
Gender Slope					
Intercept, γ_{10}	-11.0642	7.4736	7	-1.4804	.1823
Region, γ_{11}	6.1239	4.5409	7	1.3530	.2181

Random Effect	Variance	Df	χ^2	p
Intercept, u_{0j}	9.1342	8	20.0092	.0100
Gender Slope, u_{1j}	23.6652	8	15.2154	.0550
Student-level, ε_{ij}	207.8872			
Reliability Estimates	Intercept= .5979		Gender Slope= .4539	

Table 29 continued

c) Personal Organization

Fixed Effect	Coefficient	Se	Df	t	p
School Mean					
Intercept, γ_{00}	56.4804	3.0256	7	18.6676	<.001
Region, γ_{01}	-2.7321	1.8299	7	-1.4930	.1791
Gender Slope					
Intercept, γ_{10}	-23.0785	6.3440	7	-3.6370	.0085
Region, γ_{11}	9.7580	3.9061	7	2.4982	.0411
Random Effect	Variance	Df	χ^2	p	
Intercept, u_{0j}	.0785	8	33.2658	<.001	
Gender Slope, u_{1j}	2.3399	8	9.4316	.307	
Student-level, ε_{ij}	275.7030				
Reliability Estimates	Intercept = .0023		Gender Slope = .0538		

Home Environment

Fixed Effect	Coefficient	Se	Df	t	p
School Mean					
Intercept, γ_{00}	53.5016	3.4283	7	15.6058	<.001
Region, γ_{01}	-4.4232	2.0736	7	-2.1331	.0703
Gender Slope					
Intercept, γ_{10}	-30.0758	7.0940	7	-4.1980	.0038
Region, γ_{11}	14.5452	4.3718	7	3.3551	.0126
Random Effect	Variance	Df	χ^2	p	
Intercept, u_{0j}	.0592	8	25.3819	.0010	
Gender Slope, u_{1j}	1.7137	8	9.0348	.3390	
Student-level, ε_{ij}	355.5510				
Reliability Estimates	Intercept = .0018		Gender Slope = .0315		

The Chi-Square results indicated that there still remained significant residual variance in the school mean ratings in all the four factors after controlling for Gender and Region. Thus, there were other important variables that influenced students' ratings in the causal attribution factors considered here. However, no significant residual variance of the true Gender slopes remained unexplained in all the four factors. These results implied that much of the variance in the Gender effects was due to Region. These results were further confirmed by adding MNSES to the school-level equation. The results reported in Table 30 show that the additional variable had significant effect only on Effort. No significant variance in school mean ratings in effort was left unexplained. However, MNSES did not contribute significantly to the prediction of school mean, and gender effects on Instructional Strategy, Personal Organization, and Home Environment.

Table 30

HLM Results of the Causal Attribution Factors by Gender, Region, and MNSES.

a) Instructional Strategy.

Fixed Effect	Coefficient	Se	Df	t	p
School Mean					
Intercept, γ_{00}	40.3919	6.1144	6	6.6061	<.001
Region, γ_{01}	-2.5367	7.1830	6	-.3532	.7360
MNSES	3.8494	5.1453	6	.7481	.4827
Gender Slope					
Intercept, γ_{10}	-26.1160	12.7845	6	-2.0428	.0871
Region, γ_{11}	13.5084	15.3162	6	.8822	.4116
MNSES	-1.6892	10.9655	6	-.1540	.8826

Random Effect	Variance	Df	χ^2	p
Intercept, u_{0j}	.1505	7	18.7606	.009
Gender Slope, u_{1j}	1.3123	7	13.2514	.066
Student-level, ε_{ij}	420.689			
Reliability Estimates	Intercept= .0044		Gender Slope= .0086	

b) Effort

Fixed Effect	Coefficient	Se	Df	t	p
School Mean					
Intercept, γ_{00}	46.4461	5.9830	6	7.7630	<.001
Region, γ_{01}	15.1382	6.9851	6	2.1672	.0733
MNSES	-8.9810	5.0017	6	-1.7956	.1227
Gender Slope					
Intercept, γ_{10}	-6.0581	12.8050	6	-.4731	.6529
Region, γ_{11}	13.2684	15.0991	6	.8788	.4133
MNSES	-5.3619	10.8084	6	-.4961	.6375

Random Effect	Variance	Df	χ^2	p
Intercept, u_{0j}	5.9003	7	13.8552	.054
Gender Slope, u_{1j}	28.4016	7	14.7648	.038

Table 30 continued

Student-level, ε_{ij}	207.2411				
Reliability Estimates	Intercept= .4998		Gender Slope= .4943		

c) Personal Organization

Fixed Effect	Coefficient	Se	Df	t	p
School Mean					
Intercept, γ_{00}	64.7277	4.9208	6	13.1540	<.001
Region, γ_{01}	8.8964	5.7806	6	1.5390	.1747
MNSES	-8.7757	4.1407	6	-2.1194	.0783
Gender Slope					
Intercept, γ_{10}	-32.1475	10.5969	6	-3.0337	.0230
Region, γ_{11}	-3.1220	12.6702	6	-.2464	.8136
MNSES	9.6934	9.0727	6	1.0684	.3264
Random Effect	Variance	Df	χ^2	p	
Intercept, u_{0j}	.1166	7	29.1908	<.001	
Gender Slope, u_{1j}	2.7519	7	8.3342	.304	
Student-level, ε_{ij}	271.6929				
Reliability Estimates	Intercept = .0035		Gender Slope = .0649		

Home Environment

Fixed Effect	Coefficient	Se	Df	t	p
School Mean					
Intercept, γ_{00}	60.4810	5.5792	6	10.8404	<.001
Region, γ_{01}	5.4143	6.5550	6	.8260	.4404
MNSES	-7.4248	4.6954	6	-1.5813	.1649
Gender Slope					
Intercept, γ_{10}	-37.7601	11.7778	6	-3.2061	.0185
Region, γ_{11}	3.6202	14.1021	6	.2567	.8060
MNSES	8.2171	10.0985	6	.8137	.4469
Random Effect	Variance	Df	χ^2	p	
Intercept, u_{0j}	.0469	7	23.0567	.002	
Gender Slope, u_{1j}	1.2508	7	8.4179	.297	

Table 30 continued

Student-level, ε_{ij}	352.9637	
Reliability Estimates	Intercept = .0014	Gender Slope = .0220

Summary

The results of the study presented in this chapter showed that the scale used to measure students' causal attribution factors to perceived performance in mathematics had acceptable validity and reliability. The hypothesized factors of causal attribution, that included Instructional Strategy, Ability, Personal Organization, Effort, State of Health, and Home Environment were confirmed and accounted for about 52.2% of the total variance. The subscales representing these factors were also found to have acceptable psychometric characteristics.

Two major statistical analyses were done: Three-Way Analysis of Variance, and Hierarchical Linear Modelling. The ANOVA results indicated that there were significant differences:

a) between urban and rural students in mathematics scores and socio-economic status, and

b) between male and female students in socio-economic status only Male students had lower socio-economic status than female students

(c) interactions between gender and region in SES and between perceived performance and region in mathematics scores.

On the causal attribution factors, ANOVA results indicated that there were no significant differences between urban and rural and between male and female students in their mean ratings of the six causal attribution factors. However, students who perceived their performance as successful differed from those who perceived it as failure in mean ratings of ability. None of the interactions between region, gender and perceived performance was significant for all the causal attribution factors.

The HLM results indicated that only 11.9% of the variance in mathematics scores was between schools while 88.1% was at the student level. Region accounted for 71.9% of the total between school variance, however, significant variance remained unexplained in the school means in mathematics. Gender and region differences in mathematics scores were found.

An investigation of the variances in the ratings of the six causal attribution factors using HLM procedure showed that, only four of the six factors had significant between school variances. These factors were: Instructional Strategy, Personal Organization, Effort and Home Environment. Most of the variation in the ratings of Ability and State of Health was at the student level. Region was found to have a negative association with Personal Organization, and Home Environment, but had a positive relationship with Instructional Strategy, and Effort. MNSES was found to affect Effort only when used with Region at the school level. Gender was negatively related to Instructional Strategy, Personal Organization and Home Environment, but not significantly related to Effort. These results were different from those obtained using the analysis of variance. This could be due to HLM being more sensitive than analysis of variance in detecting variations between and within groups. No significant variance remained unexplained in the gender slope of the four factors when region was added to the model, however, significant variance remained unexplained in the school mean ratings of the factors. MNSES did not improve the values of the estimated parameters except for Effort when it was added together with Region in the model. All the variance in the mean rating of Effort was accounted for by gender as a student level variable and region, and MNSES as school level variables.

The findings of the study are discussed in the next chapter. Conclusions and recommendations for further research are also presented.

V. Discussion of Results and Conclusions

The discussion of the results with respect to the stated hypotheses and literature reviewed in Chapter two is presented in this chapter. The presentation is divided into the following sections:

A. A brief introduction and overview of the major findings;

B. A discussion of the findings as they relate to each hypotheses;

C. The strengths, deficits and limitations of the study; and

D. A summary, conclusions drawn from the study, and suggested recommendations.

Introduction

The major purpose of the study was to determine the relationships existing between school characteristics, students' characteristics, and the factors used by high school students in making causal attributions to perceived performance in mathematics. It was also the purpose of the study to develop and establish the psychometric characteristics (reliability and validity) of the Causal Attribution Scale. The following six factors of causal attribution were hypothesized and confirmed through the factor analysis procedure: Instructional Strategies, Ability, Personal Organization, Effort, State of Health, and Home Environment. The school characteristics considered included Region (rural/urban) and Mean Social Economic Status (MNSES). Student characteristics studied included Gender, Mathematics Score (MATSC), Perceived Performance (PERPER), Expected Performance (EXPP), and Value of School (VALSC). A total of ten schools participated in the study, six from the rural and four from the urban region. Only one class per school was selected in order to control for variation across classes in a given school. Apart from the information collected through the questionnaire, other relevant information such as the socio-economic status was obtained from the students' personal files.

The first step in the construction of the scale was the development of a pool of items measuring some of the major constructs related to causal attribution to academic performance. The literature on attribution reviewed in Chapter two was used as one source for the items.

Most research in the area of academic achievement has focussed on the reasons that students give for their performance as opposed to asking them specifically what factors affect that performance. Rotter (1966) proposed a one-dimensional classification scheme for performance based on perceptions of control (internal vs external). Attribution research (Weiner, 1971) identified four causal attributions to achievement: ability, effort, task difficulty and luck based on the two dimensions of causality (internal-external) and stability (stable-unstable). Some studies have identified a broader categorization of the causal attribution indicating that other factors can be equally important. For example, Cooper and Good (1983) identified twelve attributional categories from their research: ability, previous experience, acquired characteristics, typical effort, interest in the subject matter, immediate effort, attention, teacher, task, other students, family and physiological processes. Kovach (1992) using students with and without learning disabilities at postsecondary institutions, found that control for performance was within the student in academic skill performance and motivational issues, while ascribed to external factors for background influence, family issues, teacher related concern and inherited ability. The argument in the present study was that the type of causal attributions made by students for their performance was determined by the nature of the task, gender and the cultural experience of the students. It was further hypothesized that the contextual characteristics of the school had a significant influence on students pattern of causal attribution.

The difficulty of the task was not considered important by the students studied at the pilot stage and was therefore not included in the Causal Attribution Scale. This result differs from those of Weiner, (1979) and Cooper & Good, (1983) who considered task difficulty an important factor in making attribution in academic achievement situations.

The factor structure of the Causal Attribution Scale was investigated through confirmatory factor analysis using maximum likelihood estimation. It was found that the hypothesized factors, namely Instructional Strategy, Ability, Personal Organization, Effort, State of Health and Home Environment accounted for 52.2% of the total variance. For practical purposes these results were considered sufficient empirical evidence of construct validity of the responses to the scale.
Item analysis results showed that the whole scale and the subscales had appropriate internal consistencies. Thus the Causal Attribution Scale had the necessary psychometric characteristics and was used to assess how students made their causal attributions to perceived performance in mathematics.

Both student and school characteristics were related to the six causal attribution factors identified and confirmed in the study. Preliminary analysis showed that the majority of the students performed poorly in mathematics. As would be expected students who perceived their performance as a success had higher scores than those who perceived it as a failure. On average most of the students had moderate expectations of doing well in the future and attached high importance to attending high school. These results have implications for classroom instruction, because even with low mathematics scores students had high expectations and aspired to achieve better performance in the future. If the students current achievement motivation is well exploited by the teacher, much improvement in mathematics performance can be achieved.

Students from the urban schools had higher socio-economic status indices compared to their rural counterparts. This could be attributed partly to the fact that compared to rural families, urban family sizes are generally smaller, the education level of the parents is generally higher and the parents are involved in some form of employment. The results also showed that female students had higher socio-economic status indices than male students. This could be explained by the fact that poor families may choose to send their sons but not daughters for high school education, while the well-off families have the resources to send all their children irrespective of their sex for high school education. Thus, more female than male students who attended high school were from families of relatively high socio-economic status.

The results of the Three-Way ANOVA showed that statistically significant differences existed between urban and rural students in Mathematics Scores ($F=64.618$, $p \leq .01$) and Socio-Economic Status (SES) ($F=79.30$, $p \leq .01$). The urban students had generally higher mean scores than rural students in all the variables except in Socio-Economic Status (SES). Significant differences existed between males and females in SES ($F=25.444$, $p \leq .01$).

The ANOVA results also indicated that significant differences existed between students who perceived performance as success and those who perceived performance as failure in the following variables: Mathematics score (F=108.342, p ≤ .01) and Expected Performance (F=32.347, p ≤ .01). However, no significant differences were identified with respect to SES (F=.067, p > .05) and Value of School (F=2.329, p> .05).

There was a significant interaction between Region and Gender in SES (29.784, ≤ .01). The urban females had the highest mean rating in SES followed by urban males, and rural females had the least rating on this variable. The interaction between perceived performance and region was also significant with respect to mathematics scores. The mean scores in mathematics for the urban students who perceived their performance as success was highest, while the rural students who perceived their performance as failure had the lowest mean score. All students had similar ratings in value of school regardless of their perceived performance and region.

In order to establish whether there were differences in the means of the subscales measuring each causal attribution factor with respect to Gender, Region and Perceived Performance (PERPER), a series of Three-way ANOVA tests were done. Instructional strategy was rated as most important for perceived success by rural males and urban females, while effort attribution was rated least for perceived success by all students. The male students did not consider ability as important in making attribution for perceived success, but they considered it important for explaining perceived failure. The rural male students considered home environment as of least importance in making attribution for perceived failure, while urban males considered effort as important in making similar attributions. Female students attributed their perceived failure most to lack of ability and least to instructional strategy.

Three-Way Analysis of Variance procedures showed that there were no significant differences on the basis of gender and region in the mean ratings students assigned to the six causal attribution factors of: Instructional Strategy, Ability, Personal Organization, Effort, State of Health and Home Environment. However, significant differences existed between those students who perceived their performance as successful and those who perceived it as failure in all the six factors except in the causal attribution factor of ability. None of the interactions was significant for all the six factors.

An investigation of the variances in the ratings of the six causal attribution factors using HLM procedure showed that only four of the six factors had significant between school variances. These factors were: Instructional Strategy, Personal Organization, Effort and Home Environment. Most of the variation in the ratings of Ability and State of Health was at the student level. Region was found to have a negative association with Personal Organization, and Home Environment, but had a positive relationship with Instructional Strategy, and Effort. MNSES was found to affect Effort only when used with Region at the school level. Gender was negatively related to Instructional Strategy, Personal Organization and Home Environment, but not significantly related to Effort. These results were different from those obtained using the analysis of variance. This could be due to HLM being more sensitive than analysis of variance in detecting variations between and within groups. No significant variance remained unexplained in the gender slope of the four factors when region was added to the model, however, significant variance remained unexplained in the school mean ratings of the factors. MNSES did not improve the values of the estimated parameters except for Effort when it was added together with Region in the model. All the variance in the mean rating of Effort was accounted for by gender as a student level variable and region and MNSES as school level variables. These results are discussed in greater detail under each of the hypothesis postulated in the study.

The Findings as They Relate to Each Hypothesis

Hypothesis One:

H_{01}: Ability, Personal Organization, Effort, State of Health, Home Environment and Instructional Strategy will account for significant variance in the causal attribution factors used by high school students to explain their perceived performance in mathematics.

This hypothesis was confirmed. Confirmatory factor analysis using the maximum likelihood extraction procedure indicated that the six causal attribution factors of Instructional Strategy, Ability, Personal Organization, Effort, State of Health and Home Environment accounted for significant amount of the total variance in the attribution scale. All the six factors accounted for 52.2% of the total variance. The whole scale showed an acceptable value for internal consistency of 0.86. Similarly, the subscales representing the factors had reasonable internal consistencies.

An examination of the descriptive statistics of the six causal attribution factors showed that Instructional Strategy was commonly used in making attributions to perceived success, while lack of Ability was used for making attributions to perceived failure. Effort was considered to be of least importance in making attributions to either perceived success or perceived failure. Home Environment was considered by rural male students to be of least importance in making attributions to perceived failure, but urban males saw it as important in making similar attributions. These findings do not agree with what has been found among Western and Asian subjects. In both societies effort is considered important in making either success or failure attribution. In the present study students perceived their teacher as being responsible for their success while lack of ability was responsible for perceived failure. However, the findings of the study agree with what has been found in Asian countries and among non-Caucasian subjects who attribute success to external factors and failure to internal factors (Power &Wagner, 1983; Chandler, Sharma, & Wolt, 1983; Miller, 1984).

Some of the factors identified in this study were similar to those identified by Weiner (1971). Task difficulty which has been found to be important in attribution literature was not confirmed in this study. Mathematics is considered to be a difficult subject by the general population of Kenyan high school students (Okech, 1986) and therefore other reasons must be of importance in explaining perceived performance. The twelve categories of attribution found by Cooper and Good (1983) are close to the ones found in this study if they were to be collapsed into a few categories. Vispoel and Austin (1991), compared causal attributions for success and failure responses across four school subject areas using a sample from a junior high school. They identified the following eight causal attributions; ability, effort, strategy, interest, task difficulty, luck, family influence and teacher influence. The authors also found that students gave credit to others for their success, but refused to blame them for failure. Causal attribution patterns also differed across subject areas. Vispoel and Austin's classification of causal attributions is broader than the one presented in this study. Although the sample used in the studies are different, one thing comes out clearly, that is, students gave credit to others for success but blamed themselves for failures.

Although some factors are more general than others, these findings support the assertion that the factors used by students to make attributions are numerous and vary according to task, the context in which the attributions are made and whether the results of the task are perceived as resulting in success or failure. Using Weiner's (1986) three dimensions of causality of locus, stability and controllability the factors in this study can be represented as in Figure 1.

Hypothesis Two

H_{02}: The gender of the student will have no significant influence on the ratings assigned to the causal attribution factors.

The hypothesis was not supported by the findings. Although the ANOVA results indicated gender differences in all the six causal attribution factors, the more sensitive HLM procedure showed the existence of gender differences in Instructional Strategy, Personal Organization, Effort and Home Environment.

When compared on their ratings of the six causal attribution factors, both the male and female students rated Instructional Strategy highest in explaining their perceived success, while lack of Ability was most important for making failure

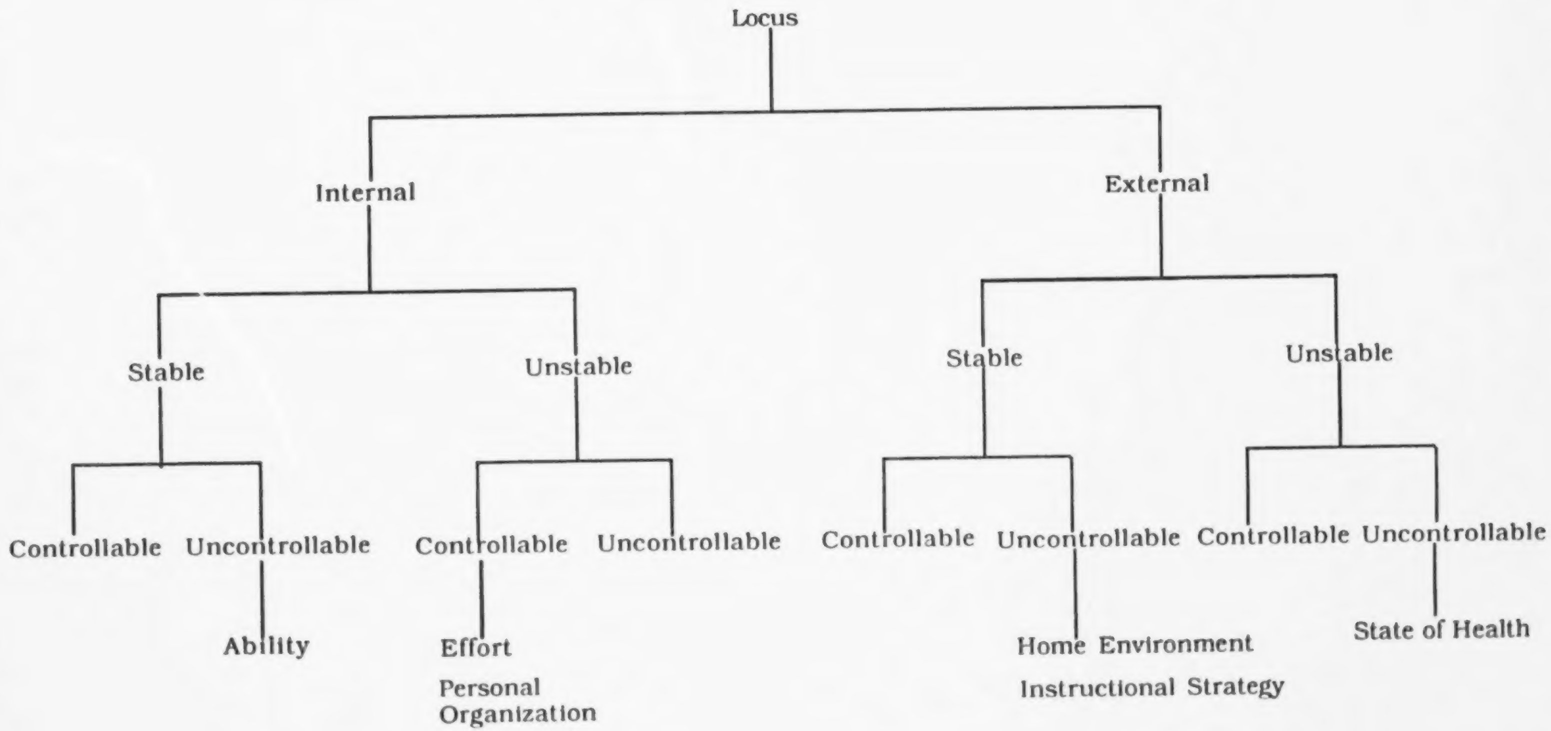
Locus
Internal
External
Stable
Unstable
Stable
Unstable
Controllable
Uncontrollable
Controllable
Uncontrollable
Controllable
Uncontrollable
Controllable
Uncontrollable
Ability
Effort
Personal Organization
Home Environment
Instructional Strategy
State of Health

Figure 1.

A Schematic Representation of the Causal Attribution Factors According to Weiner's (1986) Dimensions of Attribution.

attributions. More specifically, Instructional Strategy was rated as most important for perceived success by rural males and urban females, while effort attribution was rated least for perceived success by all students. The male students did not consider ability as important in making attribution for perceived success, but they considered it important for explaining perceived failure. The rural male students considered home environment as of least importance in making attribution for perceived failure, while urban males considered effort as important in making similar attributions. Female students attributed their perceived failure most to lack of ability and least to instructional strategy. Unlike the findings obtained using American subjects, the present study gave mixed results. Success was attributed to Instructional Strategy, an external factor, by rural males and urban females, while lack of Ability, an internal factor, was used for failure attribution by all students. Urban males rated Effort and Home Environment as important for failure attributions, while rural male students did not consider Home Environment as important for making failure attributions.

The causal attribution factors can be fitted to Weiner's (1986) dimensions of causal attribution illustrated in Figure 1. These findings do not agree with those by Lochel (1983) who found that males attributed their success more to internal factors and failure to external factors than female students. They also do not agree with those obtained by Clarkson (1983) using a sample of lower high school students from Papua New Guinea. Clarkson found no gender differences between means of ability, effort, task and environment in both success and failure conditions. It is possible that the statistical technique used by Clarkson was not able to detect gender differences as has been shown in this study when ANOVA was used. These findings are most relevant here because the sample used was from a developing country like the one used in the present study. Other studies done in different countries have also confirmed the findings on gender. Most recent of these studies is the one by Yan and Gaier (1991) in which subjects from the following groups in a American university were compared: Non-Asian American, Japanese, Koreans, and South-East Asians. Although the study found gender differences between American and Korean groups, the other nationalities showed no significant gender differences in causal attribution patterns for success and failure.

The HLM results showed that much of the variation in the six causal attribution factors were at the student level, although significant variation existed between schools. On average, gender was significantly negatively related to Instructional Strategy, Personal Organization and Home Environment, but insignificantly related to Effort. These results would imply that males had significantly higher mean ratings in the three factors but not in Effort. The estimated variances of the Gender slopes across schools were significant for Instructional Strategy (χ^2=20.1207, df=9, $p \leq .05$), Effort (χ^2=18.6160, df=9, $p \leq .05$), and Home Environment χ^2=19.6617, df=9, $p \leq .05$). This implied that there existed significant variations in Gender slopes across schools in these factors. Gender accounted for about 8.58% and 2.79% of the total variance in Instructional Strategy and Effort attributions respectively. The proportions of variance accounted for by gender, though significant, are quite small, and therefore other variables at the student level that influence these factors need to be explored. Although most of the studies quoted in the preceding paragraph and the ANOVA results in this study found no gender differences, the HLM results indicate that gender had significant influence on some causal attributions made by students in mathematics.

Hypothesis Three

H_{03}: The contextual characteristic of the school as measured by region and the mean socio-economic status of the students will have no significant influence on the causal attributions made by Kenyan high school students.

The hypothesis was not supported. This hypothesis was tested using Three-Way Analysis of Variance and hierarchical linear modeling. Region, comprised of urban and rural areas was used as a measure of students' cultural experience. The socio-economic status of the students attending a particular school was expected to have significant influence on students' causal attribution patterns. Significant differences existed between urban and rural students in Mathematics Scores, Expected Performance, Socio-Economic Status (SES), and Value of School. The mean values for all the variables for the urban students were generally higher than those of the rural students. These findings support the ideas articulated by Hanna & Hanna (1981), that there are higher academic aspirations, and stiffer competition among urban than rural students.

The causal attribution factors were compared on the basis of Perceived Performance and Region. Again significant differences were found between students with perceived performance of success and those with perceived failure in the mean ratings of the six factors. Urban and rural students did not differ significantly in their mean ratings of the six causal attribution factors. None of the interactions of Gender, Region and Perceived Performance was significant for any of the six factors.

Although the focus of the study was not on performance in mathematics per se, it was considered necessary to investigate the relationship between mathematics scores and the other variables first.

To investigate the contribution of Region, a school-level variable, to the variability of mathematics scores the One-Way Random Effect ANOVA model was modified by incorporating Region, at the school-level.

The results showed that there was a significant association between Region and mean mathematics performance (γ_{01}=-0.430, Se=0.120, t=-3.574, $p \leq 05$). On average, Region had a negative relationship with mathematics scores within schools. This result implied that urban schools' students did relatively better than rural schools' students in mathematics. This confirms the earlier findings that urban students did better that rural students in mathematics. Region accounted for about 71.9% of the true between school variance in mathematics scores. The Chi-square statistic that tests the hypothesis that the residual differences among school means were essentially zero was rejected (χ^2=16.234, $p \leq .05$), implying that Region did not account for all the significant variance in school means. Other variables not included in the model could be accounting for some of the remaining variance.

After removing the effect of Region, the intraclass correlation was 0.0368, implying that only about 3.7% of the variance in mathematics scores was between schools. This value was a conditional intraclass correlation and measured the degree of dependence among observations within schools that were from the same Region.

There were no significant gender effect differences between urban and rural schools (γ_{11}= .630, t=2.107, Se=.299 $p > .05$).

The variation in mean mathematics scores explained by Region was about 64%. A test of the hypothesis that residual variance of the true slopes was zero, that is, H_0: $\tau_{11}=0$, was rejected (χ^2 =28.623, df=7, $p \leq .01$). This indicated that significant variance in Gender effect remain unexplained even when Region was used as a predictor at the school-level.

The effect of region on the ratings of the causal attribution factors was investigated using the school means as the dependent variable and school characteristic of Region as the independent variable. Only the causal attribution factors that had significant variation across schools were considered in this model. These factors were Instructional Strategy, Personal Organization, Effort and Home Environment. The HLM results indicated that Personal Organization and Home Environment were negatively related to Region, while Instructional Strategy and Effort were positively related to Region. The results showed that urban schools had higher mean ratings in Personal Organization and Home Environment than did rural schools. However, rural schools had higher mean ratings in Instructional Strategy and Effort than urban schools.

Region accounted for about 11.24% and 6.45% of the true between school variance in Effort and Home Environment attribution factors respectively. However, Instructional Strategy and Personal Organization gave meaningless results. Instead of the school mean variance decreasing when Region was added to the school-level equation, it increased for these two factors. None of the school mean variances associated with the four factors was significant at $p \leq .05$.

Significant unexplained between school variance remained in Instructional Strategy, Personal Organization, Effort, and Home Environment even when Region was controlled for.

In order to investigate why some schools had higher means and stronger Gender association with the causal attribution factors, a model incorporating the school-level variable of Region was used. The results showed that on average, rural schools had significantly higher gender slope estimates than urban schools in their mean ratings in Instructional Strategy, Personal Organization and Home Environment at the $p \leq .05$. However, no significant Region effect on the Gender slopes was found in the mean ratings of Effort.

The Chi-Square results indicated that there still remained significant residual variance in the school mean ratings in all the four factors after controlling for Gender and Region. Thus there were other important variables that influenced students' ratings in the causal attribution factors considered here. However, no significant residual variance of the true Gender slopes remained unexplained in all the four factors. These results implied that much of the variance in the Gender effects was due to Region.

In summary, the findings in this study have indicated that there were significant differences between urban and rural students in mathematics scores, expected scores, socio-economic status, and value of high school education. Urban students had higher mean ratings on the listed variables. Significant differences were also found among the causal attributions with respect to Region. However, no significant interaction effect between region and perceived performance was found among the causal attribution factors. Instructional strategy was rated highest by both urban and rural students in making attribution for perceived success, while lack of ability was rated highest for perceived failure attributions by both groups.

These findings support the ideas expressed by Whiting (1972) that the differences in the socialization processes of the child found in urban and rural areas have significant influence on the child's personality development and perception of events in general. In particular the socialization processes have an effect on the student's attribution behavior to academic performance as is implied by the contribution of region in the prediction of the ratings on the causal attribution factors.

The findings of this study indicated that students rated Instructional Strategy (an external, stable and uncontrollable) highly in explaining their perceived success. Both the urban and the rural students considered lack of ability as most important in explaining their perceived failure.

Fry and Gosh (1980) found cultural differences in causal attributions between Orientals and Occidentals. According to the study Occidental subjects took greater credit for success and attributed failure to luck, but Oriental subjects assumed more personal responsibility for failure and attributed success to luck. Similar findings on cultural differences in attribution were obtained by Miller (1984) using western (American) and non-western (India) subjects; Power and Wagner (1983) using Hispanic and Anglo high school students and by Friend and Neale (1972), using Caucasian and African-Americans. The findings differ from those in the present study which found that both students with an urban and students with rural cultural experiences attributed their success and failure to both internal and external factors. Taken together the findings agree with those obtained using non-western subjects. It can be concluded that cultural experience has influence on causal attribution behavior, but no distinction could be made between factors used by urban and rural students for making success attributions and those used to make failure attributions

Limitations of the Study

The study was limited to high school students in Kenya. Considering the cultural issues discussed in Chapter 2, it was not possible to generalize these findings to other cultures. The study was also limited by the restricted sample used, in terms of failure to include all school types and lack of control of the sample size at each level. However, the findings of the study can be used as a basis for a cross-cultural study on causal attributions.

Being a study of social-psychological variables, there were definitely a number of extraneous variables, such as school facilities that affected the results in ways that were not considered in the study and therefore influenced the external validity of the findings. However, random sampling of the schools was expected to reduce these effects to some extent.

The Causal Attribution Scale was a limiting factor in generalizing the findings of this study to other regions and cultures. The list of causal attribution factors was far from being complete given that it was compiled using students from only two regions in Kenya. Cross-validation of the scale using subjects from other regions of Kenya and other cultures will improve the validity and reliability of the research findings.

According to Donoghue and Jenkins (1992), omitting a predictor that is correlated with one or more of the other predictors would affect greatly the estimate of level-two regression coefficients. They also pointed out that HLM models with a few units would require a large number of iterations to obtain values of the likelihood functions. These findings were obtained through a Monte Carlo study. In this study many variables that influence the causal attribution factors, for example, anxiety, were not included in the model and therefore could have an effect on the parameters estimated. The number of schools considered were only ten which led to the use of a large number of iterations before convergence was reached using the HLM procedure. These problems could be avoided by replicating the study on a large number of schools and increasing the number of variables.

Implications for Practice

The findings of this study will make a contribution to the theory and practice of causal attribution and motivation in general. The findings will be useful in understanding the role of causal attributions to the teaching/learning process especially as it relates to achievement motivation. Teachers can assist students in setting realistic goals and having them provide feedback concerning students' goal achievement. Teachers can also help students by encouraging them to examine their motives for learning and to develop personal responsibility. Personal responsibility can be taught by helping students place greater emphasis on effort as a cause of outcomes rather than blame others when they fail or believe they are lucky when they succeed.

The findings will be of value to teachers, school counsellors, school administrators, and parents, in devising ways and strategies (attribution change programs) for improving student's performance particularly in mathematics. One way this can be achieved is by designing learning tasks such that emphasis is placed on effort attribution. Giving feedback to students can also be used to foster individual evaluation based on one's own previous performance instead of comparing one's performance with other students. This approach has been found effective in fostering effort attribution as opposed to ability attribution (Schunk, 1991).

The findings of the study are also expected to provide a basis for studying causal attributions in other subjects and events that may be thought to influence student's performance in school in general.

The findings of this study have implications for cross cultural research in causal attribution. While certain causal attribution factors, as listed by Weiner (1986), have been studied in Western and Oriental cultures and found to differ in terms of perceived success and failure, findings from this study shows that other causal attribution factors are important and used differently by students from Kenya.

Finally, the findings will add empirical evidence for the existence of a number of factors used to explain a wide variety of causal attributions made by students for their academic performance.

In addition to its theoretical contribution, this study has a methodological significance. Studies using students as subjects have traditionally been done using students as the unit of analysis ignoring the effects of classrooms and schools on some students' characteristics. Currently researchers have realized the importance of taking into consideration the multi-level nature of most school data. This study adds to the increasing research evidence of the advantage of recognizing the hierarchical structure of most social institutions and use of the appropriate research design and statistical analysis of data emanating from such institutions.

Suggestions for Further Research

Given the limitations that have been cited, it is important that research work be done to validate the attribution scale used in this study. The difference between the correlations among the causal attribution factors which would have been obtained using the theoretically derived factor scores and those derived empirically implies that further refinement of the instrument is required. A more representative sample of schools drawn from all the regions in Kenya could be used to ensure external validity of the Causal Attribution Scale. The scale should also be used to study causal attribution to perceived performance in mathematics by samples of high school students drawn from other cultures, for example, Occidential, Oriental and other developing countries. This will ensure that the scale has construct validity across different cultures.

The application of the hierarchical linear model was limited by the few variables studied and the small number of schools used in the study. The same study should be replicated with a large number of schools and variables at both the student and school level.

The study should be replicated with other academic subjects and include task difficulty as one of the causal attribution factors because mathematics is perceived as a difficult subject by nearly all the students and attribution to task difficulty could not be well assessed.

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APPENDIX A: Causal Attribution Scale

DO NOT WRITE YOUR NAME ANY WHERE IN THIS QUESTIONNAIRE.

This is NOT a test and therefore there are no RIGHT or WRONG answers. Section A requires you to provide information about yourself. Sections B1, contains a list of possible causes for poor performance in mathematics while Section B2 contains causes for good performance. If you consider your performance in mathematics in the KCSE mock exam a FAILURE indicate your responses to the items in section B1, and if you consider it a SUCCESS respond to items in section B2 by choosing ONE of the following: STRONGLY AGREE (SA), AGREE (A) NOT SURE(NS) DISAGREE (D), and STRONGLY DISAGREE (SD).

SECTION A

1. Your school name. ____________________

2 Your sex. Male☐ Female☐

3. Name of your primary school. _________________

4. In which district did you attain your primary education? _________________

5. Indicate the marks and grade that you obtained in mathematics in the mock examinations. __________

6. Do you consider the grade that you have indicated in (5) above a FAILURE or a SUCCESS? Success☐ Failure☐

7. Estimate the marks or grade you had expected to obtain. ________

8. How important is high school for you? Circle accordingly.

Not important 1____2____3_____4_____5_____6_____7_____8 Very important

IF YOUR RESPONSE TO (6) ABOVE IS **FAILURE** GO TO **SECTION B1** ON PAGE (2), BUT IF IT IS **SUCCESS** GO TO **SECTION B2** ON PAGE (5).

SECTION B1

Indicate how you feel the following statements explain your FAILURE in mathematics by ticking the appropriate box below.

	Strongly Agree (S.A)	Agree (A)	Not Sure (N.S)	Disagree (D)	Strongly Disagree (S.D)
1. I did not do well because of my poor skills in mathematics.	☐	☐	☐	☐	☐
2. I am good in the other subjects, but not in mathematics.	☐	☐	☐	☐	☐
3. I don't find mathematics useful in my day to day activities outside school.	☐	☐	☐	☐	☐
4. Most of the questions that I chose to do were very difficult.	☐	☐	☐	☐	☐
5. I have lost interest in mathematics.	☐	☐	☐	☐	☐
6. I receive no encouragement from my parents to study mathematics.	☐	☐	☐	☐	☐
7. Almost every one in my family hates mathematics.	☐	☐	☐	☐	☐
8. I did not understand the teacher's class notes	☐	☐	☐	☐	☐
9. The other people who took the mathematics exam were more able than me.	☐	☐	☐	☐	☐
10. The people I was competing with had better skills in mathematics than me.	☐	☐	☐	☐	☐
11. I did not do a lot of practice before the mathematics test.	☐	☐	☐	☐	☐

(Continue next page)

	Strongly Agree (S.A)	Agree (A)	Not Sure (N.S)	Disagree (D)	Strongly Disagree (S.D)
12. I was not in the best of my moods at the time of the mathematics exam.	☐	☐	☐	☐	☐
13. I did not understand the subject because of the way the teacher was teaching it.	☐	☐	☐	☐	☐
14. I am among the students the mathematics teacher did not like.	☐	☐	☐	☐	☐
15. I was not lucky the day of the exam.	☐	☐	☐	☐	☐
16 I avoid studying anything related to mathematics outside school.	☐	☐	☐	☐	☐
17. The time allowed was not enough for me to do all the problems.	☐	☐	☐	☐	☐
18. The few problems that I got correct in the exam were just by chance.	☐	☐	☐	☐	☐
19. I would have done better if I was in a better school.	☐	☐	☐	☐	☐
20. I don't get time to do mathematics while at home.	☐	☐	☐	☐	☐
21 People of my sex normally do not do well in mathematics.	☐	☐	☐	☐	☐
22. I don't like the mathematics teacher.	☐	☐	☐	☐	☐
23. The time allowed for practise and revision for the mathematics exam was not sufficient.	☐	☐	☐	☐	☐
24. I was in bad health during the exam.	☐	☐	☐	☐	☐
25. The private coaching that I got in mathematics did not help me at all.	☐	☐	☐	☐	☐

	Strongly Agree (S.A)	Agree (A)	Not Sure (N.S)	Disagree (D)	Strongly Disagree (S.D)
26. I have a problem discussing mathematics with my classmates.	☐	☐	☐	☐	☐
27. The role I play in my family interferes with my performance in mathematics.	☐	☐	☐	☐	☐
28. The location of this school has something to do with my poor performance.	☐	☐	☐	☐	☐
29. I would have done better if I was a little more organized in my studying the subject.	☐	☐	☐	☐	☐
30. The class members were very uncooperative in helping me solve some mathematics problems.	☐	☐	☐	☐	☐
31. My level of performance has something to do with my background in the subject.	☐	☐	☐	☐	☐
32. I am responsible for my level of performance.	☐	☐	☐	☐	☐
33 The mathematics teacher is to blame for my current level of performance in the subject.	☐	☐	☐	☐	☐
34. I would have done better if I and the other class members were doing mathematics problems as a team.	☐	☐	☐	☐	☐
35. I don't consider mathematics an important subject for my future career.	☐	☐	☐	☐	☐

(END OF SECTION B1)

SECTION B2

Indicate how you feel the following statements explain your SUCCESS in mathematics by ticking the appropriate box below.

	Strongly Agree (S.A)	Agree (A)	Not Sure (N.S)	Disagree (D)	Strongly Disagree (S.D)
1. I was successful because of my good skills in mathematics.	☐	☐	☐	☐	☐
2. Mathematics is one of my best subjects.	☐	☐	☐	☐	☐
3. I receive a lot of encouragement from my parents to study mathematics.	☐	☐	☐	☐	☐
4. Most of the questions that I chose to do were easy.	☐	☐	☐	☐	☐
5. I am very interested in mathematics.	☐	☐	☐	☐	☐
6. My family puts a lot of pressure on me to study mathematics.	☐	☐	☐	☐	☐
7. Almost every one in my family does well in mathematics.	☐	☐	☐	☐	☐
8. I understood the teacher's class notes.	☐	☐	☐	☐	☐
9. The other people who took the mathematics exam were less able than me.	☐	☐	☐	☐	☐
10. The people I was competing with had poor skills in mathematics.	☐	☐	☐	☐	☐
11. I did a lot of practice before the mathematics test.	☐	☐	☐	☐	☐
12. I was in the best of my moods at the time of the mathematics exam.	☐	☐	☐	☐	☐
13. I understood the subject because of the way the teacher was teaching it.	☐	☐	☐	☐	☐

(Continue next page)

	Strongly Agree (S.A)	Agree (A)	Not Sure (N.S)	Disagree (D)	Strongly Disagree (S.D)
14. I am among the students the mathematics teacher liked most.	☐	☐	☐	☐	☐
15. I was very lucky the day of the mathematics exam.	☐	☐	☐	☐	☐
16 I like studying mathematics outside school.	☐	☐	☐	☐	☐
17. The time allowed was enough for me to do all the problems.	☐	☐	☐	☐	☐
18. I got most of the problems by chance.	☐	☐	☐	☐	☐
19. I would not have done so well if I was in another school.	☐	☐	☐	☐	☐
20. I do a lot of exercises in mathematics at home.	☐	☐	☐	☐	☐
21 People of my sex normally do well in mathematics.	☐	☐	☐	☐	☐
22. I like the mathematics teacher.	☐	☐	☐	☐	☐
23. I had enough time to practise and revise for the mathematics exam.	☐	☐	☐	☐	☐
24. I was in good health during the exam.	☐	☐	☐	☐	☐
25. The private coaching that I got in the subject helped me a lot.	☐	☐	☐	☐	☐
26. I discuss mathematics with my classmates outside the school.	☐	☐	☐	☐	☐
27. The role I play in my family does not interfere with my performance in mathematics.	☐	☐	☐	☐	☐
28. The location of this school has something to do with my performance.	☐	☐	☐	☐	☐

(Continue next page)

	Strongly Agree (S.A)	Agree (A)	Not Sure (N.S)	Disagree (D)	Strongly Disagree (S.D)
29. I would have done better if i was a bit more organized in my studying the subject.	☐	☐	☐	☐	☐
30. The class members were very cooperative in helping me solve some mathematics problems.	☐	☐	☐	☐	☐
31. My level of performance has something to do with my background in the subject.	☐	☐	☐	☐	☐
32. I am responsible for my level of performance.	☐	☐	☐	☐	☐
33 The mathematics teacher is responsible for my current level of performance.	☐	☐	☐	☐	☐
34. Because I and the other class members were doing mathematics exercises as a team.	☐	☐	☐	☐	☐
35. I consider mathematics an important subject for my future career.	☐	☐	☐	☐	☐

(END OF SECTION B2)